NASA CR 137,780

VIBRATORY HUB LOAD DATA REDUCTION AND ANALYSIS FROM THE REVERSE VELOCITY ROTOR WIND TUNNEL TEST

(NASA-CR-137780) VIBRATORY HUB LOAD DATA REDUCTION AND ANALYSIS FROM THE REVERSE VELOCITY ROTOR WIND TUNNEL TEST, PHASE 2B (Boeing Vertol Co., Philadelphia, Pa.) 163 p HC $6.75 CSCL 01A
N76-16038
Unclas
G3/02 14375

R. B. TAYLOR

JANUARY 1976

PREPARED UNDER CONTRACT NO. NAS 2-8630

FOR

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

AMES RESEARCH CENTER

BY

BOEING VERTOL COMPANY
A DIVISION OF THE BOEING COMPANY
P. O. BOX 16858
PHILADELPHIA, PENNSYLVANIA 19142

D 210-11004-1

REV LTR

BOEING VERTOL COMPANY

A DIVISION OF THE BOEING COMPANY

P.O. BOX 16858
PHILADELPHIA, PENNSYLVANIA 19142

CODE IDENT. NO. 77272

NUMBER D210-11004-1

TITLE VIBRATORY HUB LOAD DATA REDUCTION AND ANALYSIS FROM THE REVERSE VELOCITY ROTOR WIND TUNNEL TEST - PHASE IIB

ORIGINAL RELEASE DATE ________. FOR THE RELEASE DATE OF SUBSEQUENT REVISIONS, SEE THE REVISION SHEET. FOR LIMITATIONS IMPOSED ON THE DISTRIBUTION AND USE OF INFORMATION CONTAINED IN THIS DOCUMENT, SEE THE LIMITATIONS SHEET.

MODEL ________ CONTRACT [illegible]

ISSUE NO. ________ ISSUED TO: ________

PREPARED BY R. Taylor DATE Nov 6, 1975

APPROVED BY F. Tarzanin DATE

APPROVED BY F. McHugh DATE Nov 6, 1975

APPROVED BY ________ DATE ________

APPROVED BY ________ DATE ________

APPROVED BY ________ DATE ________

FORM 46280 (5/73)

SHEET

LIMITATIONS

This document is controlled by Organization 7040

All revisions to this document shall be approved by the above noted organization prior to release.

THE BOEING COMPANY

NUMBER

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVAL

FORM 46282 (3/67)

THE **BOEING** COMPANY

NUMBER
REV LTR

ACTIVE SHEET RECORD

SHEET NUMBER	REV LTR	ADDED SHEETS: SHEET NUMBER	REV LTR	ADDED SHEETS: SHEET NUMBER	REV LTR	SHEET NUMBER	REV LTR	ADDED SHEETS: SHEET NUMBER	REV LTR	ADDED SHEETS: SHEET NUMBER	REV LTR
i						35					
ii						36					
iii						37					
iv						38					
v						39					
vi						40					
vii						41					
viii						42					
ix						43					
x						44					
1						45					
2						46					
3						47					
4						48					
5						49					
6						50					
7						51					
8						52					
9						53					
10						54					
11						55					
12						56					
13						57					
14						58					
15						59					
16						60					
17						61					
18						62					
19						63					
20						64					
21						65					
22						66					
23						67					
24						68					
25						69					
26						70					
27						71					
28						72					
29						73					
30						74					
31						75					
32						76					
33						77					
34						78					

FORM 46283 (7/67)

THE **BOEING** COMPANY

NUMBER
REV LTR

ACTIVE SHEET RECORD

SHEET NUMBER	REV LTR	ADDED SHEETS: SHEET NUMBER	REV LTR	SHEET NUMBER	REV LTR	SHEET NUMBER	REV LTR	ADDED SHEETS: SHEET NUMBER	REV LTR	SHEET NUMBER	REV LTR
79						124					
80						125					
81						126					
82						127					
83						128					
84						129					
85						130					
86						131					
87						132					
88						133					
89						134					
90						135					
91						136					
92						137					
93						138					
94						139					
95						140					
96						141					
97						142					
98						143					
99						144					
100						145					
101						146					
102						147					
103											
104											
105											
106											
107											
108											
109											
110											
111											
112											
113											
114											
115											
116											
117											
118											
119											
120											
121											
122											
123											

FORM 46283 (7/67)

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF FIGURES

LIST OF FIGURES

LIST OF TABLES

ABSTRACT

This document presents the results of the vibratory hub loads data analysis from the Reverse Velocity Rotor Wind Tunnel Test - Phase IIB. Vibratory loads were obtained from the rotating hub balance and also by synthesis of generalized coordinates from the blade flap bending moments. Load trends were defined as a function of speed, rotor thrust and 2 per rev cyclic from each of the data methods. These trends were compared to determine the degree of agreement between each method and provide substantiation for the generalized coordinate approach.

FOREWARD

This report was prepared by the Boeing Vertol Company for the National Aeronautics and Space Administration, Ames Research Center under NASA Contract NAS2-8630. The report contains the vibratory hub load data reduction and analysis from the Reverse Velocity Rotor Wind Tunnel Test - Phase IIB.

Mr. Ron Smith (NASA Ames) was the technical monitor for this work.

The Boeing Vertol Program Manager was F. J. McHugh, and the Project Engineer was R. B. Taylor.

SUMMARY

Analysis of the vibratory hub loads obtained from the Reverse Velocity Rotor Wind Tunnel Test - Phase IIB was performed using hub load data obtained from a rotating balance and hub loads obtained by synthesis of general coordinates from the blade bending moments. The general results exhibited by the data indicate that vibratory thrust and overturning moments are the two loads of major concern. A second item of general relevance is the sensitivity of the results to model/test stand resonance conditions at different rotor speeds across the advance ratio range.

Figure 1 presents the two major loads, vibratory thrust and overturning moment variation with advance ratio, determined with the hub balance and generalized coordinate methods. Two peaks are evident in the vibratory thrust at advance ratios of 0.7 and 1.4. These high load conditions are due to model/test stand resonant frequencies which will be avoided on a full scale rotor system. The hub balance data indicates two high load conditions but the generalized coordinate data indicates one high load condition at $\mu=0.8$ (the 3/rev - longitudinal test stand frequency) and a suppressed load peak at $\mu=1.4$. The trend of the vibratory thrust defined by the data at nonresonant test conditions and represented by the solid line in Figure 1 indicates an increasing trend with advance ratio. Agreement of the data obtained from the hub balance and the generalized coordinate methods is good for the conditions away from a resonance condition.

At the bottom of Figure 1 is the vibratory hub overturning moment variation with advance ratio. The large load peak at an advance ratio of 1.3 is a result of the 3/rev first flexible flapwise mode. The generalized coordinate data indicates a load level significantly higher than the hub balance data. These trends resemble load growth for a system with various amounts of damping: 4% for the generalized coordinate data and 30 percent for the hub balance data. Agreement in the data defined by both methods at advance ratios below 0.8 and above 1.6 is quite good. The implication of this is that the vibratory hub moment trend with advance ratio is constant with advance ratio as represented by the solid line.

It is concluded that the generalized coordinate method would be the most reliable and representative of the full scale (no model/stand resonance conditions). Also the complexity of load measurement is less with the generalized coordinate method; 6 data channels required as compared to 10 channels required for the hub balance method.

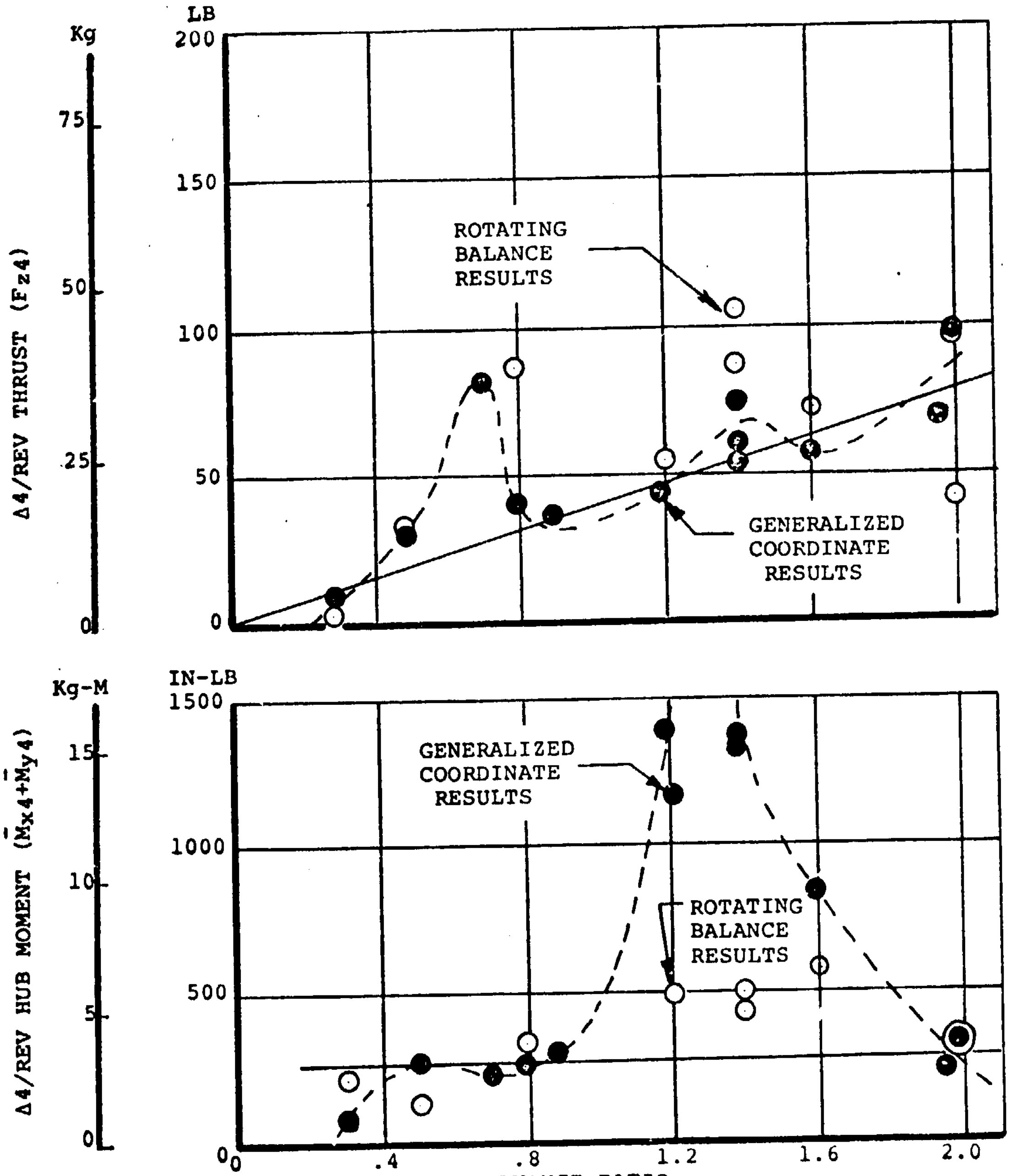


FIGURE 1 RVR WIND TUNNEL MODEL COMPARISON OF 4 PER REV FIXED SYSTEM HUB LOADS FOR ZERO 2 PER REV CYCLIC OBTAINED FROM ROTATING BALANCE AND FROM GENERALIZED COORDINATES

1.0 INTRODUCTION

For an articulated rotor,the blade vertical shears at the flapping hinge are the sole contributor to hub vibratory components of thrust, rolling moment and pitching moment. The other three hub load components (torque, longitudinal force and lateral force) are due to blade chordwise and radial shears at the lag hinge. A semiempirical analysis has been developed to determine these shears and requires measured blade flap bending and chord bending moments in addition to a dynamic description of the rotor blade.

This analysis has been used at Boeing to determine 4/rev vibratory hub vertical force on the Model 347, a tandem rotor helicopter with 4 bladed rotors. The specific objective was to determine by flight testing, the effect of blade mounted 4/rev pendulum absorbers on the blade root 4/rev vertical shears. Figures 1.1 and 1.2 show the results of that testing effort. The effect of the absorbers when they were optimumly tuned is shown in Figure 1.1 for both forward and aft rotors. These results, all of which were developed by the analysis, show a 7 to 1 reduction in blade 4/rev root vertical shears on the forward rotor at 150 knots. The upper plot in Figure 1.2 shows the effect of pendulum absorber tuning on 4/rev blade root vertical shears on the forward rotor at 150 knots. Note that maximum tuning is shown by the analysis to be at 3.95 per rev pendulum tuning. The bottom plot in Figure 1.2 shows the effect of pendulum absorber tuning on measured vertical cockpit accelerations. The effect of tuning is very similar to that for the vertical shears for the plot above with minimum acceleration occurring at 3.95 per rev tuning. If the vertical shears and accelerations were normalized by their respective values for no pendulum absorbers (the baseline value), the nondimensional results would be nearly the same for vertical shear and cockpit acceleration. A more detailed discussion of this application of generalized coordinates is contained in Reference 1.

The degree of correlation obtained in the previous application indicated that the analysis had merit and would be a valuable asset to future rotor research programs. It needed additional substantiation for the loads on an isolated rotor test program that not only had adequate blade instrumentation to define the shears at the flap and lag hinges but also direct measurement of the vibratory hub loads. The capability to measure hub loads was being integrated into the Reverse Velocity Rotor Model. A recommendation was made to provide additional blade instrumentation for the purpose of providing a backup source of obtaining vibratory hub loads data as well as providing an additional degree of substantiation. NASA provided the additional instrumentation required to obtain the data that is presented in the following sections.

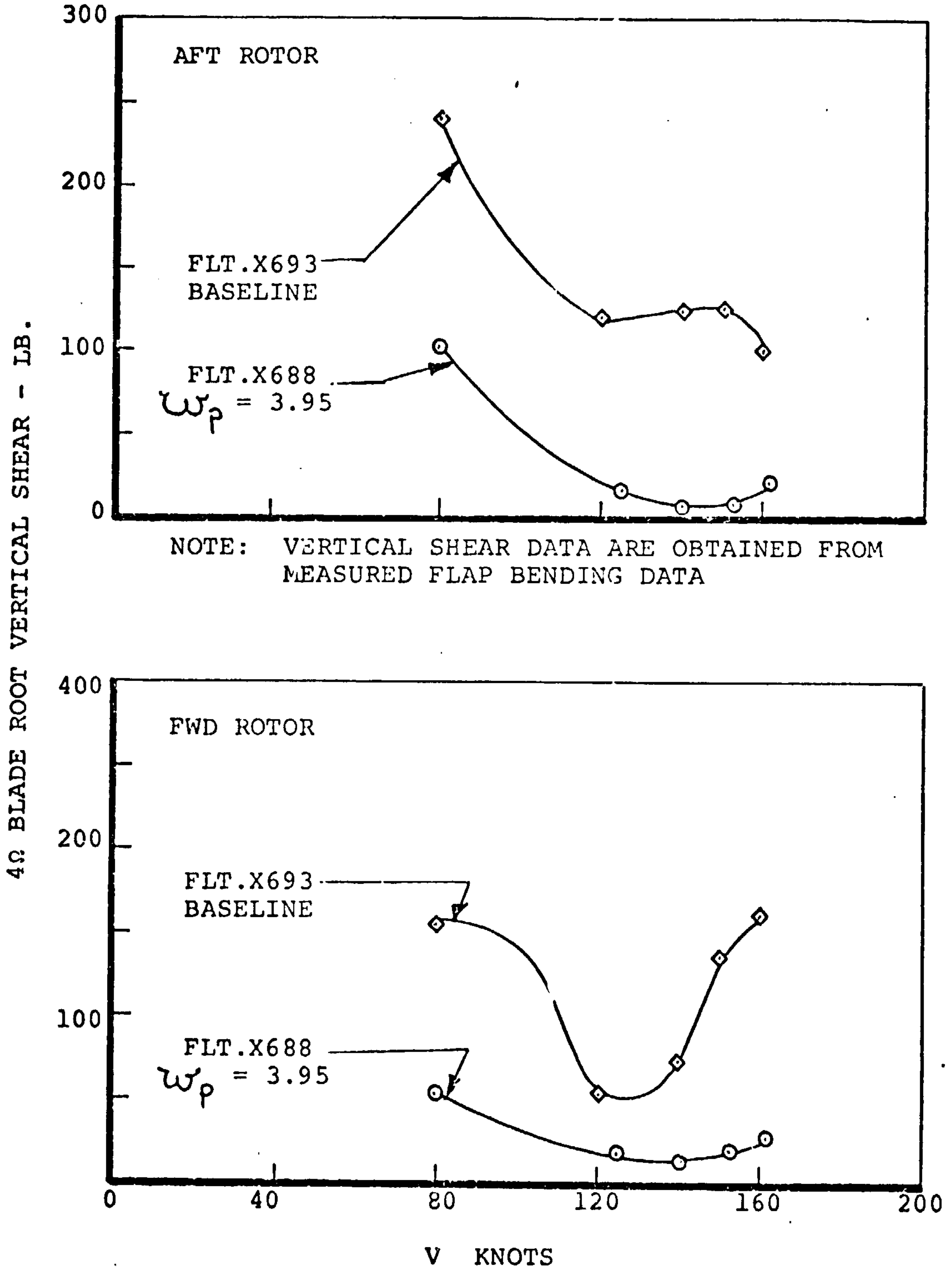


Figure 1.1 MODEL 347 PENDULUM ABSORBER - 4Ω BLADE ROOT VERTICAL SHEAR RESULTS

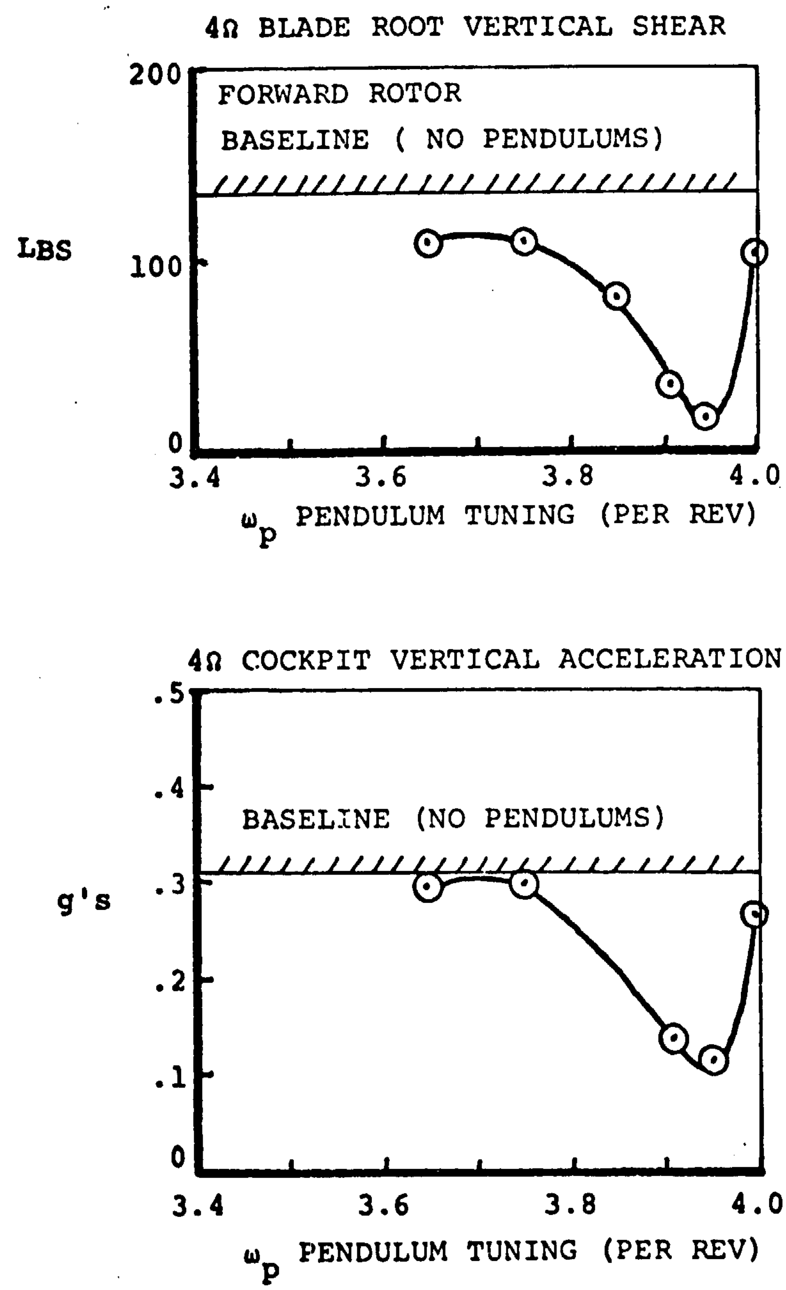


Figure 1.2 - MODEL 347 EFFECT OF PENDULUM ABSORBER TUNING ON 4Ω BLADE ROOT VERTICAL SHEARS AND MEASURED COCKPIT VERTICAL ACCELERATION AT 150 KTS

2.0 DESCRIPTION OF MODEL AND TEST STAND

2.1 General

The Reverse Velocity Rotor Model was tested in NASA Ames 12 foot pressure tunnel. Figure 2.1 shows the installation in the tunnel of this 8 foot diameter, four bladed rotor mounted on the test stand. The rotor, control system and hydraulic motor are all mounted on a base plate carried on the NASA Ames 2.5 in. diameter High Endurance Main balance. This total model loads is mounted in a "Y" shaped support frame that can be pivoted on a floor mounted pedestal, as shown in Figure 2.2. The rotor shaft angle can be varied from 5° forward to 12.5° aft using the angle of attack mechanism to drive the "Y" support frame. The whole unit is enclosed in an upper fairing around the hub and a lower fairing around the control system, "Y" support frame and pedestal.

The hub fairing, hub and blades are mounted on a balance carried on the top of the rotor shaft for measuring six components of vibratory rotor loads. Figure 2.3 shows the geometric layout of the hub, hub balance as well as the base plate and main balance.

2.2 Rotor Blades

The rotor characteristics presented in Table 2-1 define the blade geometric and structural properties. The rotor blades are of constant chord with a root cutout at 23 percent radius. The Fairchild developed reversible airfoil sections are a 1.5 percent cambered, 6% thick section at the tip and a 3.5 percent cambered, 18% thick section at the root, with linear taper root to tip. The airfoil sections at root, tip and midspan are shown in Figure 2.4

and ordinates for these sections are given in Table 1-II of Reference 2. A cross-section of one of the blades is shown in Figure 2.5. The aluminum upper and lower skins have chordwise and spanwise thickness variations formed by chemical milling. A C-spar, which is bonded to the skins over the full span at the chordwise change of skin thickness, is machiend integrally with the root end attachment. The skins are bonded to an aluminum wedge at the trailing edge and a bronze wedge at the leading edge which serves as a balance weight. An aluminum honeycomb core is machined to the internal contour and serves as a tie between the upper and lower skins as well as a forming core for the bonding operation. Strain gages were bonded internally to the spar on two of the blades at three radial stations (.37R, .51R and .70R) to measure flap bending stresses as shown in Figure 2.6.

The rotor blade was designed with maximum torsional stiffness at minimum weight as a prime concern. The bonded metal structure was found to be the minimum cost and minimum risk approach for achieving this. The resulting blade Lock number is 2.1 at sea level which is much less than that of conventional helicopter rotor blades.

The rotor shear center and pitch axis were placed at 27.5 percent chord and the section c.g. near 30 percent chord. This configuration was found to be near optimum from studies of flap-torsion dynamic stability at high advance ratio. Plots of the rotor blade physical properties including the measured and theoretical spanwise variation of bending and torsional stiffness are given in

Reference 3. The natural frequency spectrum of the rotor blade modes in a vacuum is shown in Figure 2.7.

2.3 Rotor Hub

The rotor hub is a 4-bladed fully articulated type with provisions made for various values of delta-3 feedback; however, due to lack of time only a delta-3 angle of 26.5 degrees was used in this series of tests. The coincident flap and lag hinges are positioned at 6.5 percent of the blade radius.

Mechanical damping of the blades is provided about the lag hinge by rotary viscous dampers mounted above the rotor hub. The dampers provide approximately 130% critical damping about the lag hinge to minimize the potential of a ground resonance-type instability of the rotor mounted on the flexible balance.

In order to measure vibratory loads a NASA 6-component strain gage balance was installed in the hub so that all loads from the rotor hub to the shaft are carried through this balance. Together with the strain gaging of the pitch links and the measurement of accelerations in three axes at the hub, this enables vertical and in plane vibratory forces to be determined.

The hub is fully faired by a spun metal fairing with cut-outs to permit blade flapping, and shields mounted on the blade cuffs to close the cut-outs.

2.4 Control System

The control system shown in Figure 2.9 has a conventional three - actuator - controlled swashplate to provide collective pitch and one - per - rev cyclic pitch. The actuators are set at 90°, 180° and 270° azimuthal positions and are remotely operated with controls for collective, longitudinal cyclic and lateral cyclic. Instead of operating the incidence rods directly, the swashplate outer ring carries four levers which allow for the addition of a two-per-rev input to the swashplate motion.

The two-per-rev motion is generated by a lower swashplate and a shaft driven at twice rotor rpm. In previous tests the two-per-rev motion was transferred to the upper swashplate level by an external sleeve. To minimize inertia forces the two-per-rev motion is transmitted upward by a column that is now positioned inside the main rotor shaft. A crosshead, attached to the top of the column, projects through slots in the wall of the shaft and is connected to the mixing levers on the upper swashplate.

To achieve a satisfactory life, all two-per-rev bearings except the swashplate bearing are lubricated by a pressure fed oil supply from an external system. The two-per-rev generating mechanism is enclosed in a cylindrical housing with a sump inside the drive pulley to collect the oil from the bearings.

The self-contained lubrication system consists of an approximately 5 gallon tank equipped with a 5 horsepower pump with pressure relief, and a pair of 1 horsepower scavenge pumps working in parallel. The oil in the tank is cooled by a fresh water supply.

2.5 Drive System

The rotor is driven through a toothed belt by a hydraulic motor mounted on the baseplate. The belt passes around the upper hydraulic motor drive pulley (21 teeth) and the rotor shaft pulley (60 teeth). A second identical drive pulley on the hydraulic motor is connected by a second toothed belt to the two-per-rev generator drive pulley (30 teeth). The ratio of hydraulic motor rpm to rotor shaft rpm is 2.857:1 and the ratio of the two-per-rev generator rpm to rotor shaft rpm is 2.0:1. When it is not required to operate the two-per-rev mechanism, the lower belt can be removed and the two-per-rev sleeve locked in its central position. The phasing of the two-per-rev input to the main rotor shaft is accomplished by the relationship of the rotor and two-per-rev pulleys; phasing can readily be changed after slackening off one or both of the drive belts.

The hydraulic motor is driven by a self-contained hydraulic power pack located outside the wind tunnel shell, consisting of an electric motor, pumps, reservoir, filters, control and relief valves, etc. The power pack can be remotely controlled from the wind tunnel control room. Provision is made for controlled braking of the rotor to prevent overspeeding in the windmilling case, and also for auto-matic control of rotor speed.

Since the hydraulic motor is mounted on the metric part of the system, connection between it and the pedestal is through pressure-balanced swivel joints. Tare effects due to the load path across these swivels and pipes were tested for and found to be zero. The swivels also allow for the change of alignment of the hydraulic piping when the rotor shaft angle is altered.

2.6 Instrumentation

The rotor blades were fitted with bending bridges measuring flapwise bending stress at 3 blade stations: .37, .51 and .71 radius, as shown in Figure 2.6. The gages were mounted internally so as not to affect the airfoil characteristics. An additional blade was instrumented by NASA to measure bending stresses at four radial stations flapwise (.26R, .40R, .65R, and .795R) and three radial stations chordwise (.26R, .40R and .60R) as shown in Figure 2.8. This increased instrumentation provided a more detail coverage of flapwise bending and a radial distribution of the chordwise bending. The placement of these gages on the exterior of the blade was defined to provide coverage for the first two flapwise modes and the first chordwise mode for use in the semi-empirical method of obtaining vibratory hub loads.

Vibratory chordwise blade stresses were monitored by axial strain gage measurements on the lag damper rod linkage which is equivalent to monitoring the root vibratory moment. Axial strain was measured on the pitch link for purposes both of monitoring control system stresses and blade torsional loads and to enable the vibratory forces measured at the hub balance to be corrected for pitch link loads.

All of the above quantities were displayed on oscilloscopes which were triggered from a pulse at zero azimuth position on number 1 blade to indicate the phasing of the response on the scopes. The information was also recorded on oscillographs.

The positions of the electric actuators which govern the swash-plate motion and two-per-rev pitch amplitude were measured using linear potentiometers of inifinte resolution. These voltages were read in the control room using digitally indicating millivolt potentiometers. The pots were wired and calibrated in terms of collective pitch, longitudinal cyclic pitch, lateral cyclic pitch, and two-per-rev pitch amplitude.

Rotor speed was measured by the voltage output of a D.C. generator driven by the hydraulic motor. A second indication of rotor speed was obtained by using a magnetic pickup triggered by a 60 tooth gear on the rotor shaft and connected to a counter with a digital display.

The voltage output from the NASA balance gages was filtered through the millivolt potentiometers (Imps) so that only the steady values remained; these were displayed in raw form on the "Imps" so that rolling moment at balance, rotor thrust, rotor drag and side force could be monitored during testing. The balance vibratory loads were also displayed on an oscillograph for monitoring of balance stresses and/or resonant conditions.

All the non-vibratory information i.e., rotor speed, steady balance loads, control positions in terms of collective, longitudinal, lateral, and 2/rev amplitude, and coning angle were automatically recorded at each test run on paper tape. The balance data was corrected for the primary interactions on a computer with on-line capability. The rotor behavior was made visible in the control room by means of closed circuit television and recorded on video tape.

FIGURE 2.1. REVERSE VELOCITY ROTOR TEST STAND INSTALLATION IN NASA AMES 12 FT. PRESSURE TUNNEL (LOOKING UP STREAM)

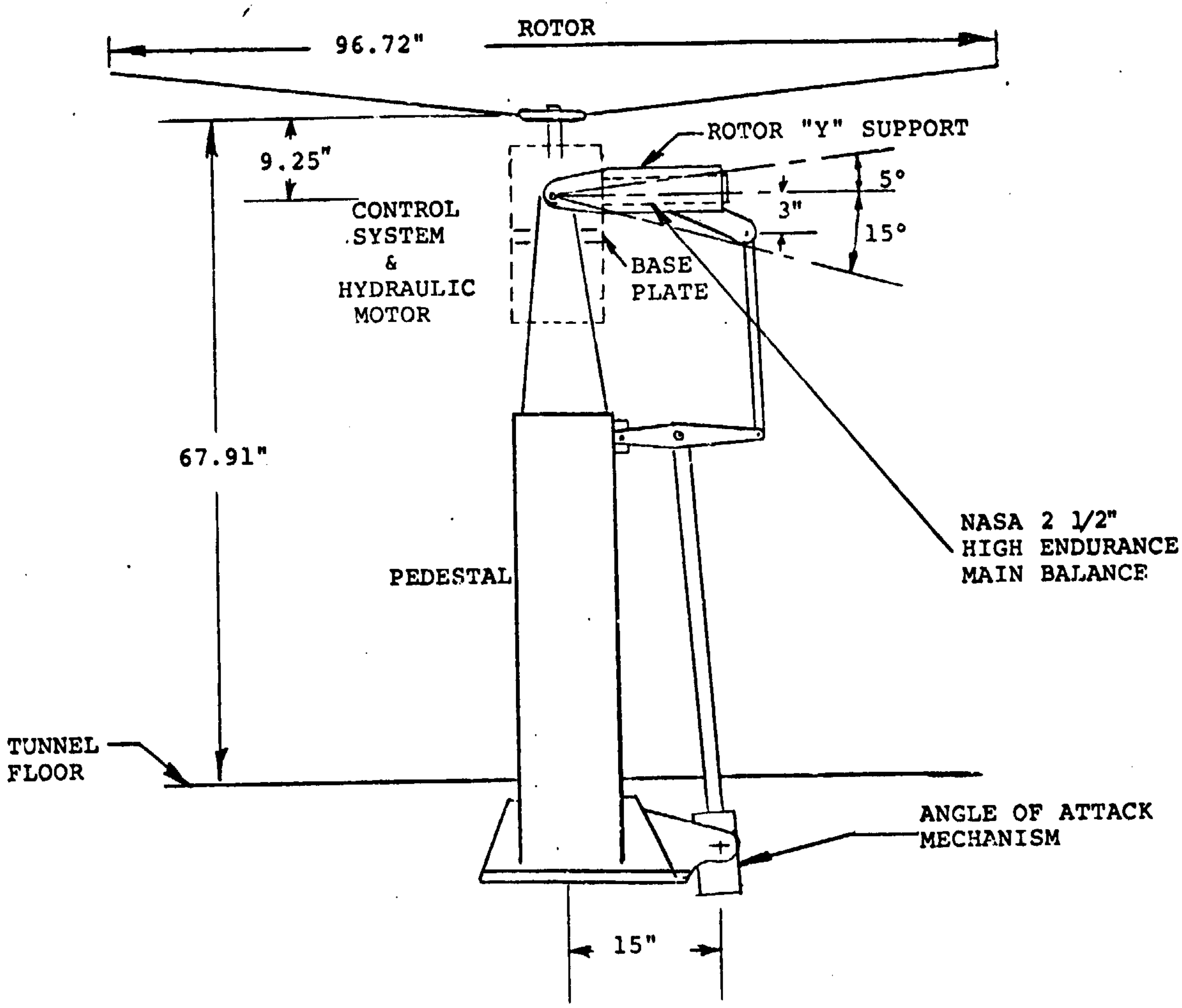


FIGURE 2.2. REVERSE VELOCITY ROTOR TEST STAND ARRANGEMENT OF MODEL AND PEDESTAL IN THE TUNNEL

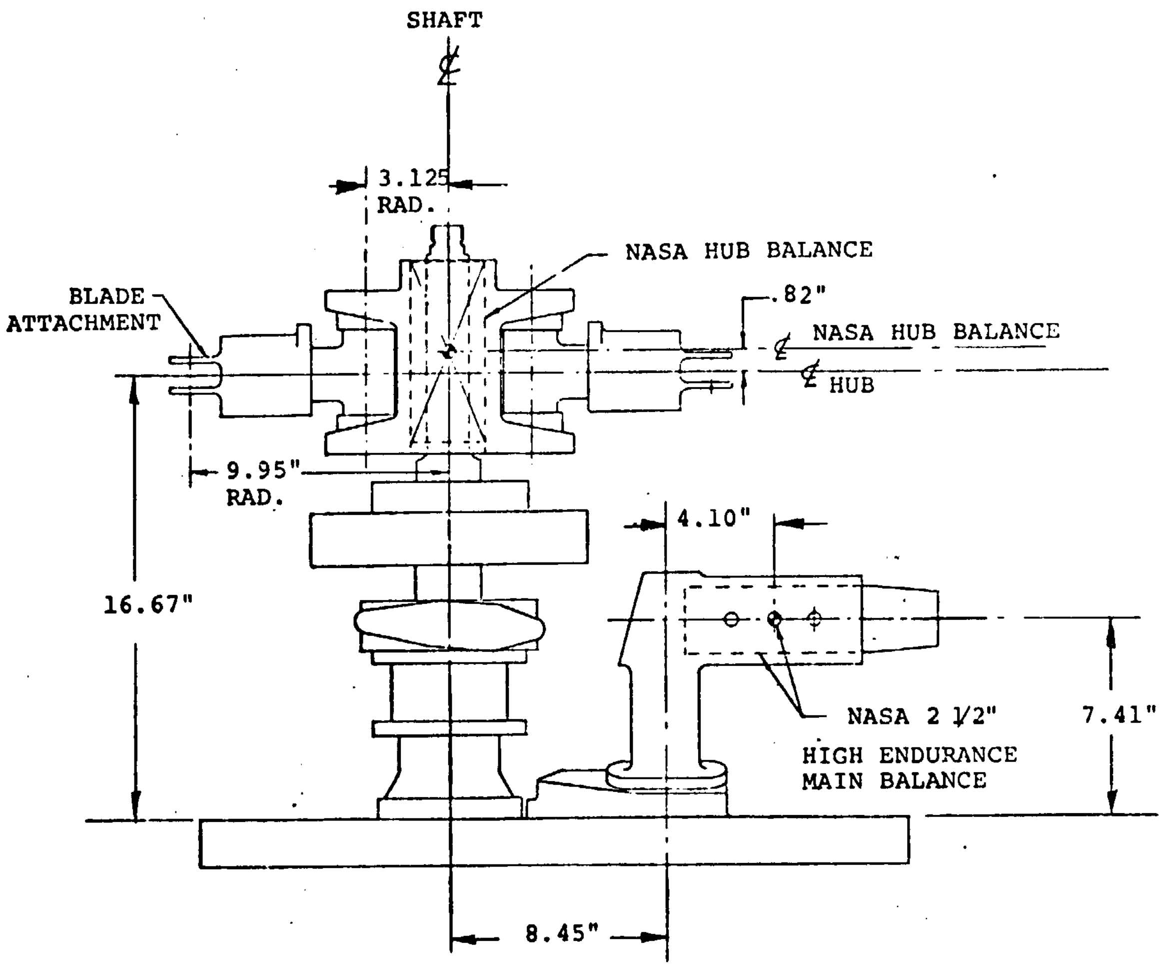


FIGURE 2.3. REVERSE VELOCITY ROTOR TEST STAND GEOMETRIC LAYOUT

TABLE 2-1 ROTOR CHARACTERISTICS

Item	Value
Scaled Vehicle Gross Weight	400 lb
Disk Loading	8.0 lb/sq.ft.
Solidity	.133
Hover Tip Speed	700 ft/sec
Number of Blades	4
Rotor Radius	48.36 in.
Blade Chord (Constant)	5.0 in.
Blade Linear Twist	0
Root Cutoff/Blade Radius	.23
Flapping Inertia per Blade	.8504 slug ft^2
Flapping Moment per Blade	12.697 lb.ft.
Lock Number (sea level atmosphere)	2.3
Lag Hinge Offset/Rotor Radius	.065
Pitch Flap Coupling Angle - Delta-3	26.5deg*

*Other values available were not used during this test program.

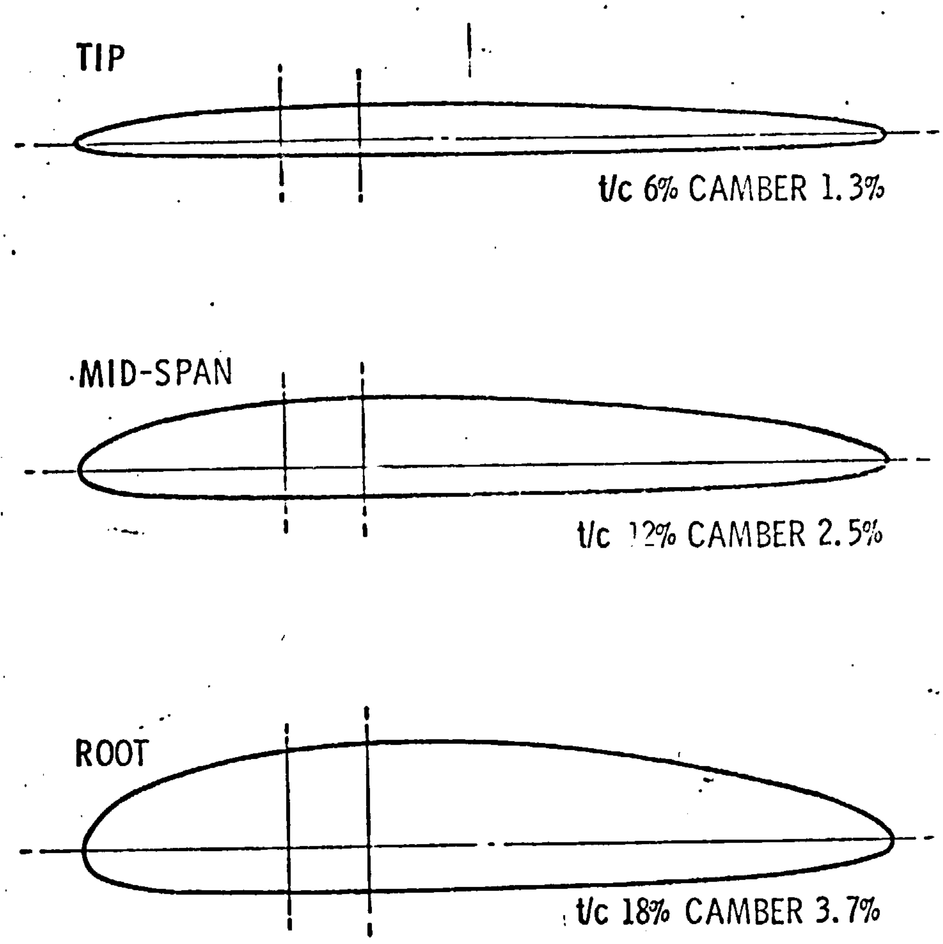


FIGURE 2.4. MODEL ROTOR AIRFOIL SECTIONS

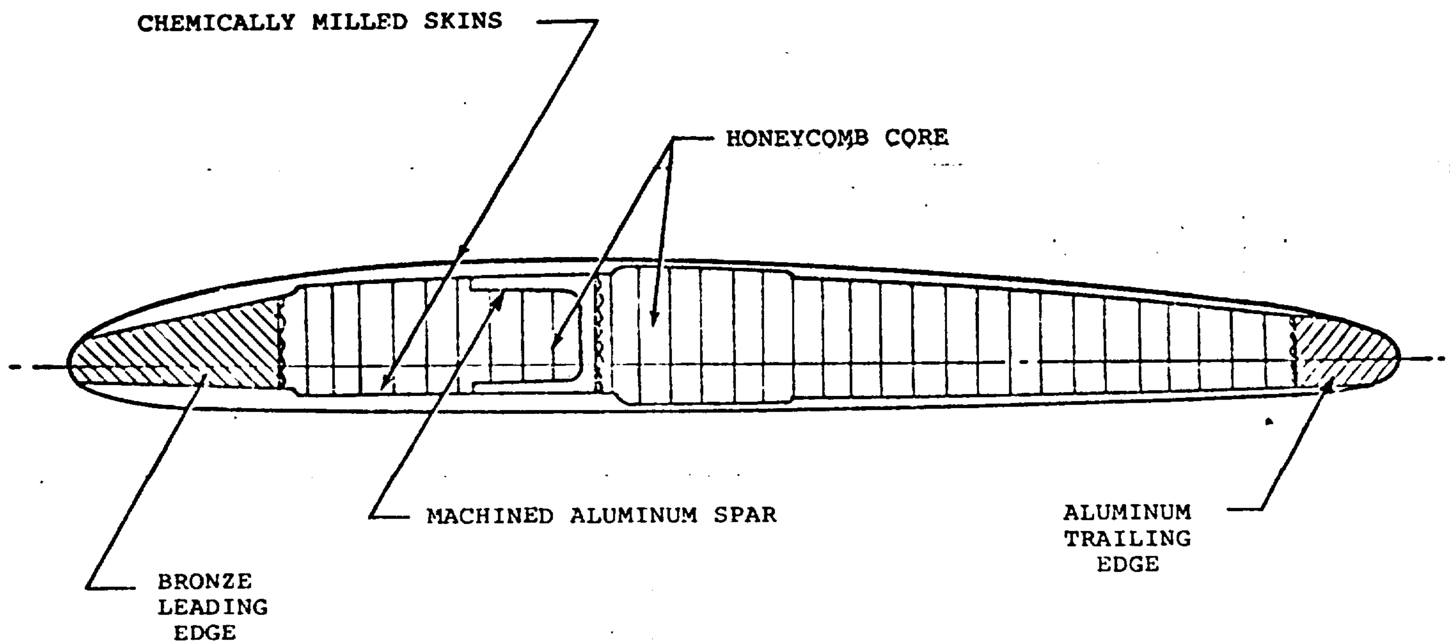


FIGURE 2.5. TYPICAL CROSS-SECTION OF MODEL ROTOR BLADE

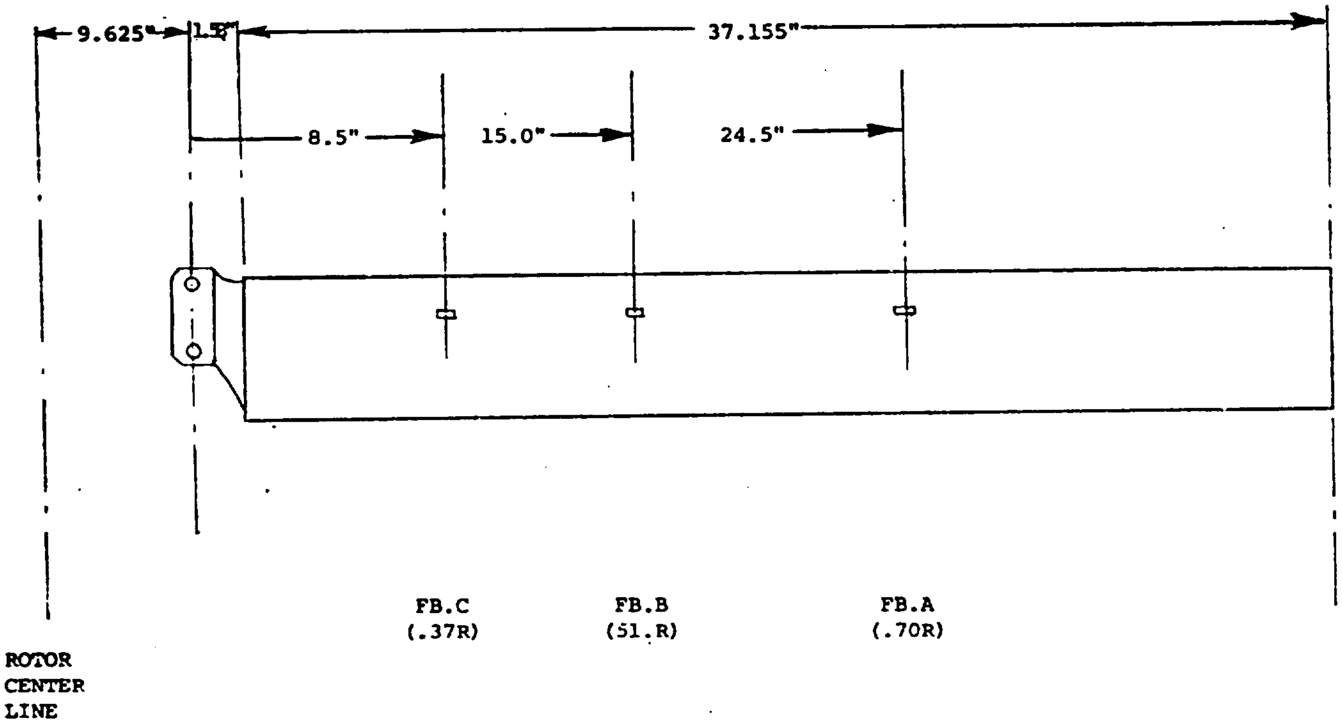


FIGURE 2.6 RVR BLADE STRAIN GAGE LOCATION
INTERNAL INSTRUMENTATION - FAIRCHILD

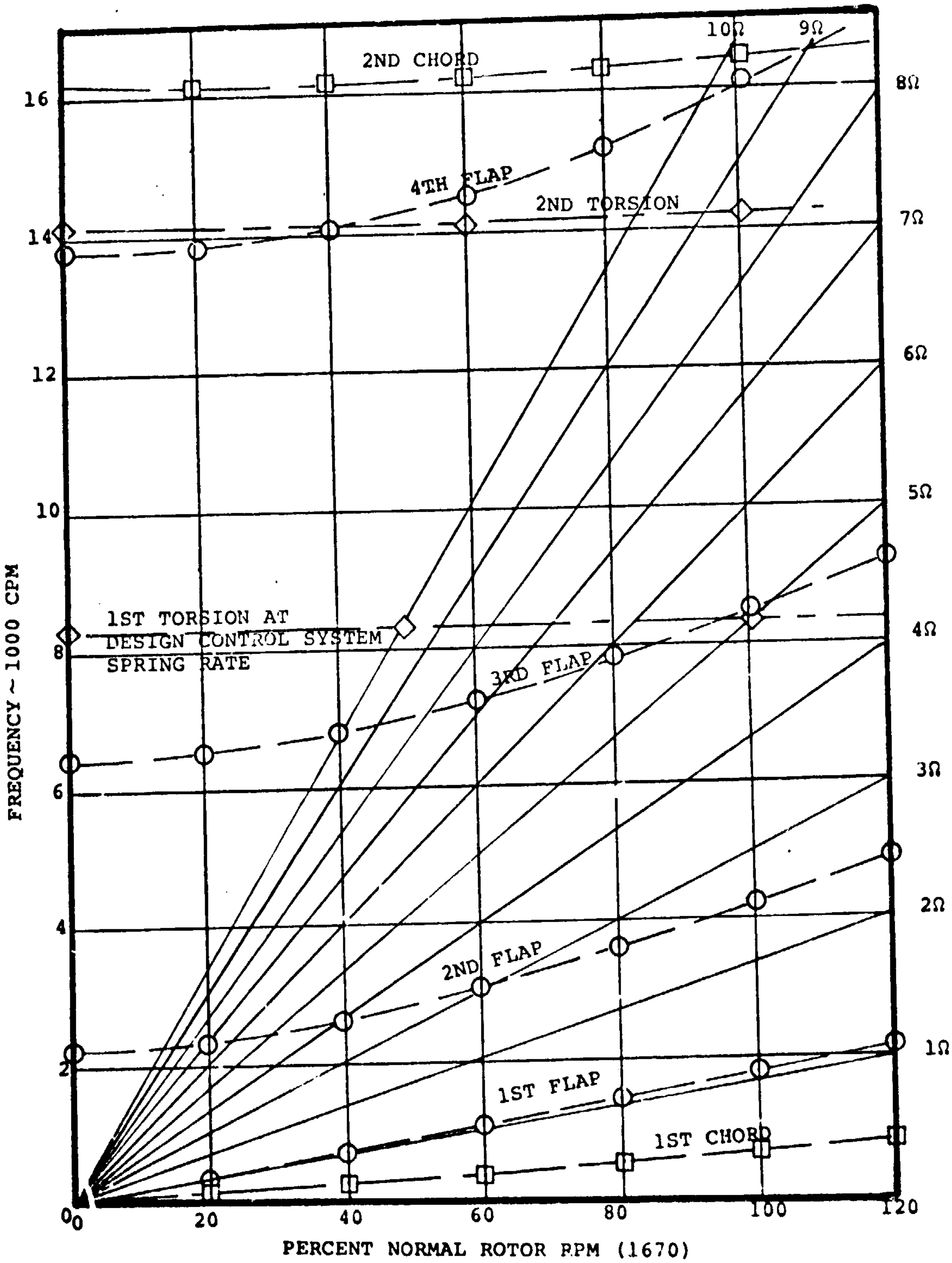


FIGURE 2.7. NATURAL FREQUENCY SPECTRUM
1/7 SCALE MODEL RVR ROTOR BLADE

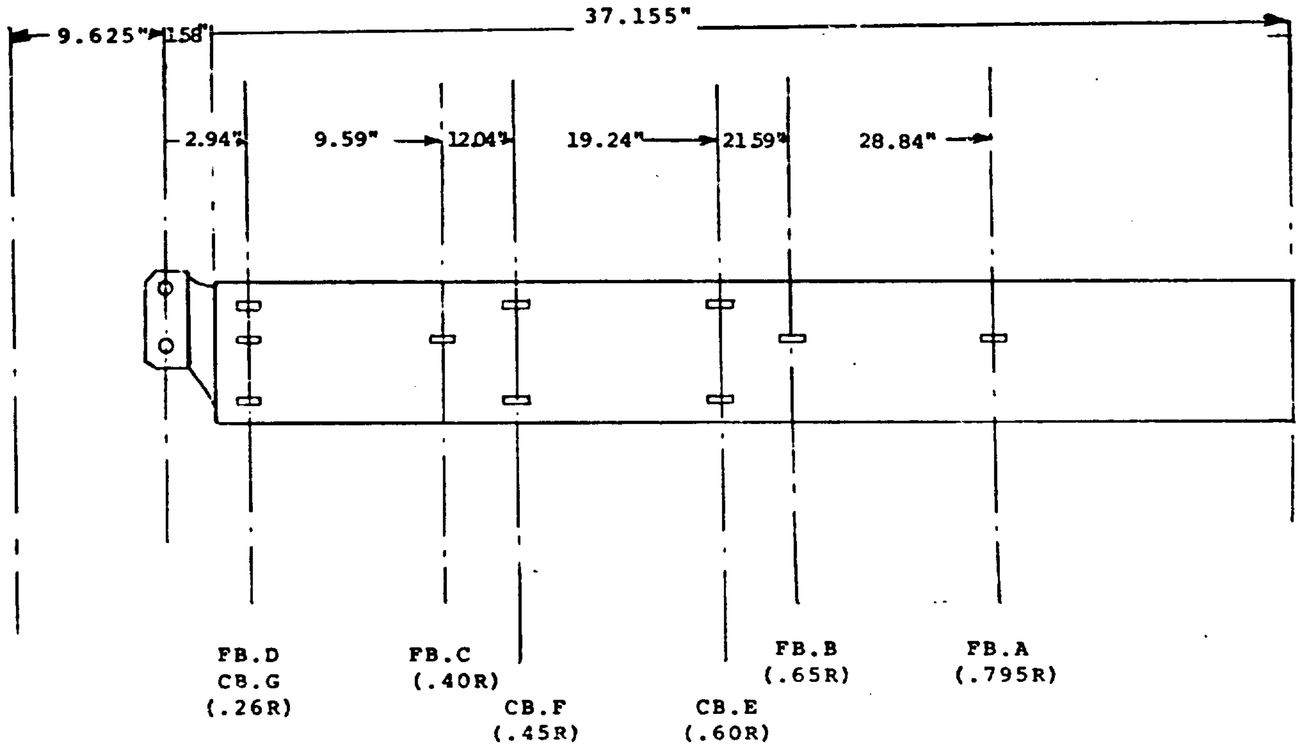


FIGURE 2.8 RVR BLADE STRAIN GAGE LOCATION
EXTERNAL INSTRUMENTATION - NASA

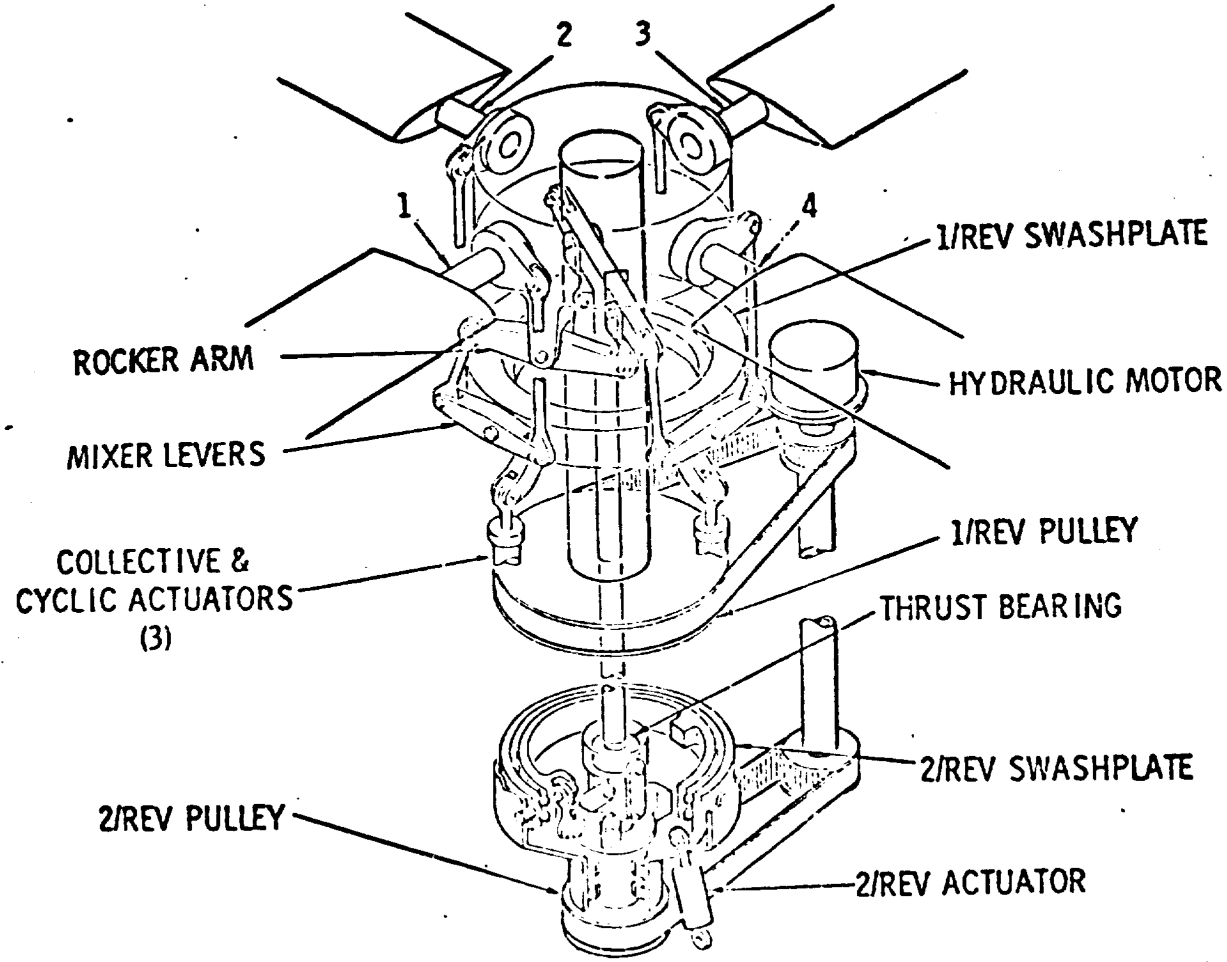


FIGURE 2.9. REVERSE VELOCITY ROTOR MODEL CONTROL SYSTEM

3.0 TEST RESULTS

The test results are separated into two categories: a) the six component hub loads obtained from the rotating hub balance and b) the hub loads obtained by synthesis of general coordinates from the blade bending moments. Hub balance results were obtained over an advance ratio range from $\mu = 0.3$ to 2.0 as shown in Table 3.1. Hub loads obtained from the generalized coordinate method were calculated for the same test conditions as the hub balance results, and additional test conditions where no hub balance data are available were analyzed to better identify data trends.

Analysis of both categories of hub load data addresses the three major test variables: advance ratio, thrust and two per rev cyclic. These three parameters are considered the most important for the RVR for the following reasons:

1. Rotor vibratory loads and helicopter vibration increases with advance ratio and the advance ratio range for the RVR is approximately 4 to 5 times greater than that of conventional helicopters.

2. Maneuvers require increased thrust capability which result in higher vibratory loads and increased vibration in the current helicopters. The impact of maneuvers or increased thrust at the higher speeds of the RVR could be intensified.

3. The use of 2P cyclic is required in the transition from low speed to high speed for stall delay. This use of (2P) cyclic is one fundamental difference between the RVR and conventional helicopters and the higher harmonic excitation from 2P cyclic provides a potential source of higher vibratory loads.

The discussion of the test results are presented in this sequence for the hub balance data and then for the generalized coordinate hub loads. The results from the two methods are then compared showing the relationship of vibratory thrust and overturning moment.

3.1 Hub Balance Data

Vibratory hub loads data were obtained from the rotating hub balance for all six components (three forces and three moments). A detailed description of the data reduction equations are presented in Appendix A and the tabulated test results are presented in Appendix B. Since the model is a 4-bladed rotor, the 4/rev component of these loads is the largest contributor to vibration and the results shown in this section are exclusively 4th harmonic content in the fixed system. The 4/rev fixed system hub loads are summarized in Appendix C and are presented in the following discussion.

The basic hub loads data obtained from the hub balance for a range of collective pitch are shown in Figures 3.1 thru 3.6. These data are plotted as a function of advance ratio and form the basis of the hub balance results. All the data shown are for zero 2 per rev cyclic and for a 5 degree aft shaft tilt except the data at $\mu = 1.2$.

which is 7.5 degrees aft shaft tilt. (No hub balance data was obtained at 5.0 degrees aft shaft tilt for an advance ratio of 1.2.) The advancing tip Mach numbers for these data are between .85 and .92 except for the = 2.0 data for which the advancing tip Mach number is .77. The test results for all six hub loads components generally show a lot of data scatter. The vibratory torque is quite small for an 8 foot diameter full scale tip speed model so the amount of data scatter present in the data is typical for a model of this size. With respect to the remaining five hub loads components there are three probable sources of data scatter:

1. For a constant advance ratio, each data point is for a different collective pitch and steady thrust level. (A parametric study of thrust effects will later show this to be an important factor.)

2. The correction factors to the basic hub balance loads could vary widely because of appreciable model test stand vibration.

3. Blade flapping may not be trimmed to zero for each test data point.

In order to minimize data scatter and isolate the effect of advance ratio, the hub loads data were plotted as a function of thrust to determine the 1"g" level flight loads. Then like components (Fx and Fy) and (Mx and My) were combined vectorially to produce one in-plane force and one resultant overturning hub moment. The vector addition of these components minimizes the effect of changes in phase of 3/rev and 5/rev forces acting on the hub balance.

For example, the hub loads data tabulation in Appendix B show that for the same test conditions the 4/rev longitudinal force is small compared to the lateral force, or vice versa, with little change in the resultant inplane component. The test data shows the same to be true for the pitch and roll moments. Treating the data in this manner reduces the hub loads components to four: vibratory thrust, torque, in-plane force and overturning moment. The 1g thrust results for these data are shown in Figures 3.7 and 3.8. The vibratory thrust and overturning moment are shown together as are the vibratory torque and in-plane force. This grouping was done purposely since each pair of hub loads components has the same primary source of vibration forcing. Vibratory thrust and overturning moment come from blade root vertical shears produced by blade flapping or out-of-plane motion. For a 4-bladed rotor, 4/rev fixed system thrust comes solely from 4/rev blade vertical shears. Likewise, 4/rev fixed system hub moments come from 3/rev and 5/rev blade vertical shears. The 3/rev and 5/rev shears trigonometrically add to 4/rev in the transformation from the rotating to fixed systems while the 4/rev rotating moment contributions cancel in the transformation. Vibratory in-plane force and torque are primarily due to blade chordwise shears. This is produced by blade lead-lag or in-plane motion, and by trigonometric addition, the 4/rev root shears are the source of 4/rev torque and 3/rev and 5/rev root shears are the source of the 4/rev in-plane force.

All four hub loads components have definite trends with advance ratio for 1g lift and zero 2/rev cyclic. In Figure 3.7, vibratory thrust has two local maximums at $\mu=.7$ and 1.6 for the advance ratio range up to 2 while vibratory overturning moment has a single peak at $\mu=1.2$. The double peaks for thrust cannot be clearly explained. The source of the 4/rev fixed system thrust is blade root vertical 4/rev shears and the dominant blade mode is the first flexible flapwise mode. The highest 4/rev response of this mode would be expected at its 4/rev resonant frequency, and this resonant point occurs at an advance ratio slightly greater than 2 for normal advancing tip Mach numbers. Therefore, the advance ratio of maximum vertical response is outside the range covered and no firm reason can be given for the two response peaks for 4/rev thrust.

There is a model/test stand 3/rev longitudinal frequency resonance at the rotor RPM for $\mu=1.6$ and a 2/rev longitudinal frequency resonance at the rotor RPM for $\mu=0.8$ as indicated in Appendix F, Figures F.3 and F.4. It is also possible that a model/test stand natural mode of higher frequency occur at these rotor speeds but were not detected by the shake test. These modes could possibly contribute to the amplification of the 4/rev vertical shears and result in the high loads presented in Figure 3.7. The hub balance data reduction program is designed to correct for model shaking effects, but the problem obviously becomes more difficult for near-resonant conditions. An important point to consider is that, if the peaks are caused by model/test stand natural frequencies, the amplified loads will not be present on a full scale RVR rotor, and the load level of $\mu = 0.5$, and 2.0 would be more representative of the actual load; therefore, the level of maximum load is more than halved. Of course, it is possible that full scale fuselage (natural modes) will amplify the vibration but the identification of such modes is possible only in an advanced preliminary design stage.

The 4/rev overturning moment peak at $\mu = 1.2$ is expected and is clearly due to a first flexible flapwise mode (2nd flap) 3/rev resonant frequency condition at this advance ratio. (Refer to Appendix F, Figure F.1). Three per rev and 5/rev rotating vertical shears combine to form 4/rev moments in the fixed system so 4/rev fixed system moment peaks can be expected at the 3/rev flap crossing (μ=1.2) and at the 5/rev flap crossing (μ>>2).

The 4/rev inplane force results in Figure 3.8 have the same double peak characteristic as the vertical force results. There is a peak near μ=1.6 and the 3/rev model/test stand natural mode resonant condition at this point is suspected to be the potential source of the amplification while the peak at μ=0.8 is possibly caused by the 2/rev model/test stand natural mode resonant condition. The double peaks of 4/rev in-plane force dominate the in-plane loads forcing up to μ=2.0; so if the peaks are due to model/test stand natural modes which will not be present on a full scale RVR, the realistic in-plane vibration is much lower than the peaks and about equal in magnitude to the 4/rev thrust loads at μ=0.3, 1.0 and 2.0.

The 4/rev torque results in Figure 3.8 are small compared to the 4/rev hub overturning moment. The trend shows a slight peak at $\mu=1.2$ but the overall magnitude is so small that the 4/rev torque loading can be considered inconsequential.

The results shown in Figures 3.7 and 3.8 are for 1g lift conditions at each advance ratio. Comparing these results with the data shown previously in Figures 3.1 thru 3.6 it is clear that steady rotor thrust has an impact on 4/rev hub vibration. This effect of steady rotor thrust is shown in Figures 3.9 and 3.10 for zero 2/rev cyclic. The gradients of 4/rev hub loads with thrust are shown as a function of advance ratio. This method of data presentation shows hub loads sensitivities to lift over the advance ratio test range.

Figure 3.9 shows the vibratory thrust and hub moment sensitivity to g's thrust for thrust excursions from a 1g condition. The most important result of this figure is that the data collapse to definite trends with advance ratio for both 4/rev thrust and 4/rev moment. The highest sensitivity of vibratory thrust to g's thrust occurs at $\mu=1.4$ which is close to the condition of highest vibratory thrust at 1g (shown in Figure 3.7). At this point the loads increase at the rate of 40 lb per .1g so that for .4g's the increase is about 160 lb. or roughly equal to the 1g loads. Therefore vibratory thrust in a 45 degree banked turn (1.4g's) at $\mu=1.4$ would be double the level flight loads at the same advance ratio. Performing the same banked turn at higher or lower advance ratios results in a lower gradient of vibratory thrust. The vibratory hub moment has a similar thrust sensitivity trend but the peak hub moment gradient occurs at μ=1.2 As previously discussed, the first flexible flapwise mode 3/rev resonant frequency occurs near this advance ratio so maximum amplification of thrust induced hub moments can be expected at this point. Increasing or decreasing advance ratio from this point results in lower thrust sensitivity but another peak can be expected at higher advance ratio for which the first flexible flap mode 5/rev resonant frequency occurs.

The percentage variation of vibratory hub moment sensitivity to thrust about the 1g condition at μ=1.2 is about the same as that of the peak vibratory thrust gradient. The vibratory hub moment doubles for an increase of .4g's (equiv. to a 45 deg banked turn). Results for the effect of Δg's thrust on vibratory in-plane force and torque are shown in Figure 3.10. Vibratory torque sensitivity to thrust is comparable to the 1g level flight loads since both are quite small compared to the other hub load components.

The vibratory in-plane force results show a high sensitivity to g's and this sensitivity changes rapidly with advance ratio. At μ=1.2, the change in 4/rev in-plane force per 0.1g thrust change is about 36 percent of the 1g load in Figure 3.8, so the vibratory in-plane force would increase by a factor of 2.5 over 1g loads for a 45 degree banked turn.

The effect of 2 per rev cyclic on 4/rev hub loads is shown in Figure 3.11 and 3.12. The results are presented as gradients per degree of 2 per rev cyclic for different advance ratios. The sensitivity of 4 per rev thrust to two per rev cyclic decreases nearly linearly with increasing advance ratio. At μ=2.0 vibratory thrust is not affected by 2 per rev cyclic, and at the advance ratio for highest 1g level flight loads (μ=1.6), 2 degrees of 2 per rev cyclic will increase 4/rev thrust 33% over 1g loads. So the effect of 2 per rev cyclic on 4/rev thrust can be termed moderate, particularly since there is no increased sensitivity to 2 per rev cyclic at the advance ratio for highest 1g vibratory thrust.

Sensitivity of 4/rev hub overturning moment to 2 per rev cyclic is nearly constant across the advance ratio range. At an advance ratio of 1.2, 2 deg of 2 per rev cyclic will increase the 4 per rev hub moments by 67% of the 1g loads.

Figure 3.12 shows the 2 per rev cyclic effects on vibratory torque and in-plane force. Vibratory torque sensitivity is shown by the cross-hatched area. Data scatter of vibratory torque with 2 per rev cyclic is large. A trend with a band width equal to the 1g vibratory torque is shown but this is quite small relative to the magnitude of vibratory hub overturning moments, and the loads shown can be considered inconsequential. The trend of 4/rev in-plane force with 2/rev cyclic is quite smooth with increasing advance ratio. Sensitivity decreases with increasing advance ratio and at the condition of highest 1g loads (μ=1.4) 2 degrees of 2 per rev cyclic increases the in-plane force 40% over 1g loads.

3.2 Vibratory Hub Loads Obtained From Generalized Coordinates

This section summarizes the vibratory hub loads data obtained by using the generalized coordinate approach. Derivation of the approach is contained in Appendix D and a tabulation of all the hub loads calculated by this approach is included in Appendix E.

All of the hub loads data in this section were calculated by using the flapping degree of freedom generalized coordinate; that is, the coordinate obtained from the radial distribution of the blade flap bending moment. For an articulated rotor, the source of hub loads for this degree of freedom are the blade root vertical shears at the flapping pin. Four per rev blade root vertical shears result in 4/rev fixed system thrust and 3 and 5/rev blade root vertical shears combine trigonometrically to yield 4/rev fixed system hub overturning moments. The remaining three components (2 orthogonal in-plane forces and torque) require calculation of generalized coordinates for the in-plane degree of freedom, which in turn requires a measured chord bending moment radial distribution. Chord bending moments were not measured for the test runs shown in Table 3.1.

Testing performed late in the program with a blade instrumented for chordwise bending moment indicated that the alternating chordwise bending moments were very small, approximately 1/10 of the flap bending moments, and were predominantly 1/rev,not 3, 4 or 5/rev. The combination of very high chordwise stiffness and high chordwise natural frequencies result in small chord bending moment amplitudes that are difficult to accurately measure. The recorded load amplitude was considered to be below the level that the instrumentation and conditioning equipment could accurately handle. It is therefore doubtful that the generalized coordinate method could be applied in the chordwise direction for this particular blade and provide meaningful results. This does not have a significant impact on the overall analysis effort and results since the hub balance data in Section 3.1 indicate that the vibratory thrust and hub moment are the two most important hub load components. The generalized coordinate results for these flap dependent components were obtained and are discussed in this section.

The vibratory thrust results obtained from generalized coordinates are shown in Figure 3.13 for zero 2 per rev cyclic. The thrust trend shows a steadily increasing load with increasing advance ratio. There are two local maximum points at μ=.7 and μ=1.4. But the important result is the apparent direct relationship between vibratory thrust and advance ratio. Unlike the 4/rev hub moment with a localized area of load amplification 4/rev thrust grows steadily worse with no indication of relief over the test advance ratio range.

Figures 3.14 and 3.15 show the vibratory 4 per rev hub moment results obtained from generalized coordinates. In order to provide a direct comparison with the hub balance data, the 4/rev hub pitch and roll moments have been combined vectorially to form one hub overturning moment. Figure 3.13 and 3.14 show the calculated hub moment as a function of advance ratio and rotor speed, respectively, for zero 2 per rev cyclic at 1g thrust. The hub moment trend peaks at μ=1.3 or about 1050 RPM. The gradient is quite high above and below the maximum load. This peak is due to the 3/rev frequency crossing of the first flexible flapwise mode. These results clearly indicate that the hub moments and associated vibration can be sharply reduced by avoidance of this resonant frequency point.

Figure 3.16 shows the sensitivity of the vibratory thrust to 2 per rev cyclic. The results for 2 deg and 2 per rev cyclic are quite close to the vibratory thrust trend for no 2 per rev cyclic. The sensitivity of unsteady thrust to 2 per rev cyclic is small and even appears negative at μ=1.4. It is clear that the primary forcing of 4/rev thrust is fundamental airloading with advance ratio and not 2 per rev cyclic.

The effect of 2 per rev cyclic on 4/rev hub moment as calculated by generalized coordinates is shown in Figure 3.16. The trend of hub moment with advance ratio for zero 2 per rev cyclic is compared with the results for 2 degree of 2 per rev cyclic. There is an increase in hub moment sensitivity with 2 per rev cyclic but the increase is nearly independent of advance ratio. Compared to the hub moment amplification at $\mu=1.3$, the effect of 2 per rev cyclic is small.

3.3 Comparison of Balance and Generalized Coordinate Data

Based upon the results shown in the previous two sections, a comparison between hub loads obtained from the rotating hub balance and those obtained from generalized coordinates can be made.

The comparison is limited to those 4 per rev hub loads components obtained from generalized coordinates: vertical force and hub overturning moment. Rotating hub balance data points corresponding to the generalized coordinate data of Figures 3.13 and 3.14 will be comapred and related to the 1 "G" hub balance data fairing of Figure 3.7. This is done in Figure 3.18 which presents the 4/rev thrust and hub moment results for both methods as a function of advance ratio. The vibratory thrust comparison indicates similarities and also fundamental differences in results between the two methods. The rotating balance results are double peaked with local maximum at $\mu=.7$ and 1.6 whereas the generalized coordinates results exhibit only one distinct peak at the lower advance ratio followed by a trend of steadily increasing load with advance ratio. As previously discussed, the local maximums are most likely due to model/test stand resonant frequencies which will not be present on a full scale rotor system.

The rotating balance results are generally substantially larger than the generalized coordinate loads but the trend is decreasing load for high advance ratios compared to increasing load for the generalized coordinate results. It is possible that the vibratory thrust trend with high advance ratios as measured by a balance is obscured by the resonant frequency response at μ=1.6 and also any factors influencing additional forcing (model hub motions, deflections, etc.). It appears that the real vibratory load levels are best represented by the results from the generalized coordinate method. This is indicated by magnitude comparisons at μ=0.3, 0.5, 1.2 and 2.0 where the vibratory thrust results are believed to be unamplified due to model/test stand natural frequencies.

The vibratory hub moment comparison (Figure 3.18) shows areas of good agreement and poor agreement between results for both methods. The delineator between good and poor correlation is obviously the effect of the 3/rev flap mode frequency crossing near μ=1.3. For advance ratios well removed from this point of amplification, agreement between methods is very good. For advance ratios approaching the 3/rev resonant frequency crossing, the agreement becomes poorer. The rotating balance results show less sensitivity than the generalized coordinate results to the blade 3/rev crossing. The difference in magnitude is about a factor of 3 and the reason for this difference is unknown. The rotating balance data appears to be damped appreciably more at the resonant frequency crossing, but whether this characteristic is peculiar to the rotating balance cannot be ascertained.

Figure 3.19 is a comparison between methods showing the effect of 2/rev cyclic for both vibratory thrust and hub moment. The results are presented as a delta change in load per degree of 2 per rev cyclic as a function of advance ratio. For vibratory thrust, the comparison shows that results obtained from generalized coordinates are nearly insensitive to 2 per rev cyclic over an advance ratio range of μ=.8 to 2.0. The magnitude is approximately 10 lbs (.05 g's) per degree of 2 per rev cyclic and the direction of change is slightly positive for low advance ratios reducing to zero for the highest advance ratios. The implication is that a slight change in the 4/rev vibratory thrust results from 2 per rev cyclic at all advance ratios tested. The rotating balance results differ only in the magnitude of the vibratory thrust change with 2 per rev cyclic. It is substantially larger than that indicated by the generalized coordinate results, particularly for the lower advance ratios. The rate is about 40 lbs. (.20 g's) per degree of 2 per rev cyclic. This rate decreases with advance ratio to about 10 lbs (.05 g's) per degree at μ=2.0.

The differences between 4/rev thrust results with 2 per rev cyclic for the two methods cannot be explained. Little is known about higher harmonic cyclic effects on off-harmonics, such as the case here. Intuitively it would seem that 2/rev cyclic should affect 4/rev thrust only indirectly since the major effect involved is an azimuthal redistribution of 1/rev airloads with 2 per rev cyclic rather than development of 2/rev, 3/rev or 4/rev airloading.

This result occurs largely because of the nose down phasing of 2/rev cyclic on the advancing and retreating sides. A diametric change in 2 per rev cyclic phasing would be more likely to produce higher harmonics of airloading, although again, the major change would be a change in 1/rev airloading. The implication is that the best estimate of 2/rev cyclic effects on thrust is little or no change in 4/rev thrust. For this case the generalized coordinate results are probably closer to the actual load.

Results for hub moment sensitivity to 2 per rev cyclic are compared in the lower half of Figure 3.19. The generalized coordinate results indicate a low sensitivity of hub moment to 2 per rev cyclic. The direction of sensitivity is increasing hub moment with 2 per rev cyclic and the magnitude is about 100 in.lb/degree. This sensitivity is quite small compared to the high hub moments for zero two per rev cyclic near the 3 per rev flap frequency crossing shown in Figure 3.18. For a large range of advance ratio, these 1g loads without 2 per rev cyclic are at least 10 times larger than the max load change for 1 degree for 2 per rev cyclic. However, for advance ratios above and below 3 per rev crossing, the sensitivity to 2 per rev cyclic approaches the 1g loads and therefore becomes more important. For example, μ=1.0, 1 degree of 2 per rev cyclic increases the hub moment 16 percent over 1g loads without 2 per rev cyclic and at μ=2.0 the increase is 100%. The rotating balance hub moment results are more sensitive to 2 per rev cyclic between advance ratios of 0.8 and 1.4. The highest sensitivity occurs at μ=1.2 where the increment due to 1 degree of 2 per rev cyclic is

40 percent of the 1g load without 2 per rev cyclic but is three times greater than that defined by the generalized coordinate method.

For increasing advance ratios from 1.2, the sensitivity slowly decreases, approaching the level defined by the generalized coordinates. The hub moment obtained from generalized coordinates shows no significant changes in sensitivity at these conditions, but rather a smooth trend with advance ratio. Just as for the vibratory thrust results, it is difficult to determine what trend is more nearly correct (hub balance or generalized coordinate). The primary difference between the vibratory thrust and hub moment results is the presence of a real dynamic resonance point with a strong effect on hub moments but no logical effect on vibratory thrust. In this sense the vibratory thrust results are more clearly forced response with 2 per rev cyclic altering the forcing. The exception to this is the probable presence of model/test stand natural modes that affect 4 per rev thrust response, as shown by the rotating balance results. The dynamic resonance point affecting hub moments is a fundamental characteristic of the rotor system and it will occur as long as the rotor speed is sufficiently reduced to approach the 3/rev 2nd flap mode frequency. Therefore, for the hub balance, it is quite possible that 2/rev cyclic has a larger effect on the 4/rev hub moments which come from 3/rev vertical shears, than on 4/rev thrust. The extent to which the sensitivity should increase for hub moment is not known but the generalized coordinate trends are considered closer to that for a full scale rotor.

RUN	μ	RPM	M_{190}	α_s	$\theta_{2\rho}$
84*	.7	1440	.92	5	0, 2, 4
85*	.9	1300	.92	5	0, 2, 4
86*	1.2	1120	.92	5	0, 2, 4
87*	1.4	960	.85	5	0, 2, 4
88	.3	1670	.81	5	0
89	.5	1630	.92	5	0
90	.79	1360	.92	5	0, 2, 4
91	1.4	950	.85	5	0, 1, 2, 3
92	1.6	880	.85	5	0, 1, 2
116	1.4	950	.84	7.5	0
118	1.95	725	.78	0	0
121	2.0	700	.77	5	0, 1, 2
123	1.2	1140	.92	7.5	0, 2, 4

* Generalized Coordinate Analysis Only

Table 3-1 Test Conditions For Which Vibratory Hub Loads Data Are Available

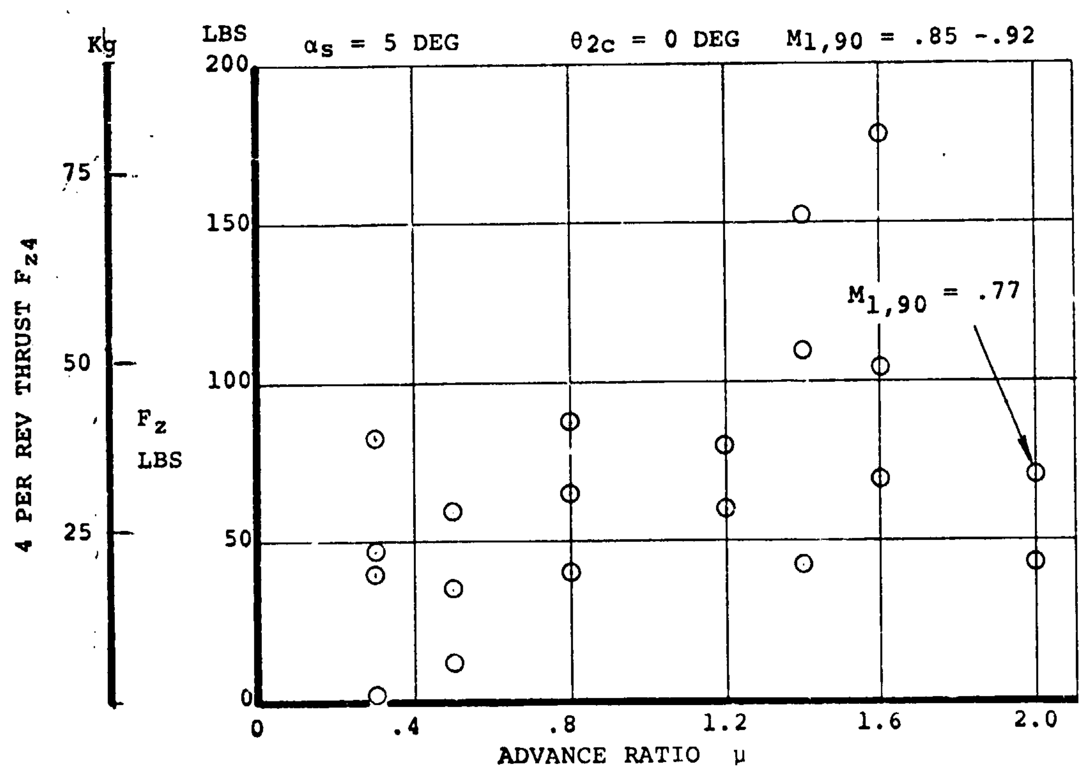


FIGURE 3.1 RVR WIND TUNNEL MODEL 4 PER REV FIXED SYSTEM THRUST FOR 5 DEG AFT SHAFT TILT AND ZERO 2 PER REV CYCLIC (ROTATING HUB BALANCE DATA)

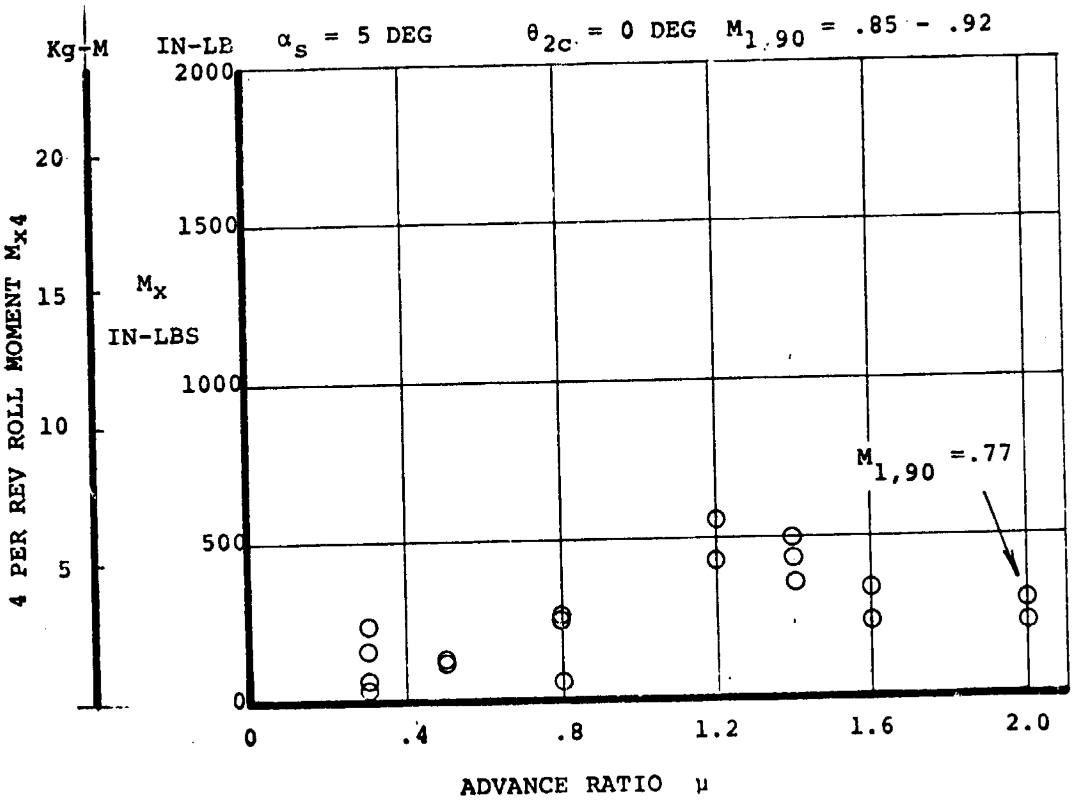


FIGURE 3.2 RVR WIND TUNNEL MODEL 4 PER REV FIXED SYSTEM ROLL MOMENT FOR 5 DEG AFT SHAFT TILT AND ZERO 2 PER REV CYCLIC (ROTATING HUB BALANCE DATA)

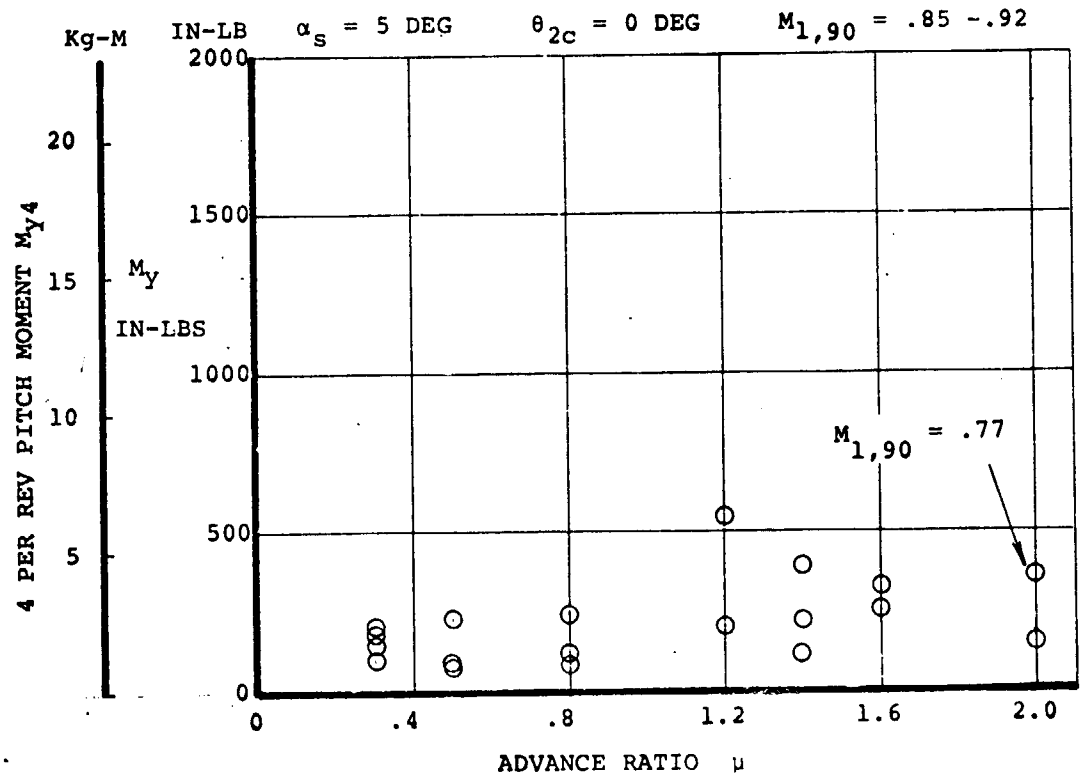


FIGURE 3.3 RVR WIND TUNNEL MODEL 4 PER REV FIXED SYSTEM PITCH MOMENT FOR 5 DEG AFT SHAFT TILT AND ZERO 2 PER REV CYCLIC (ROTATING HUB BALANCE DATA)

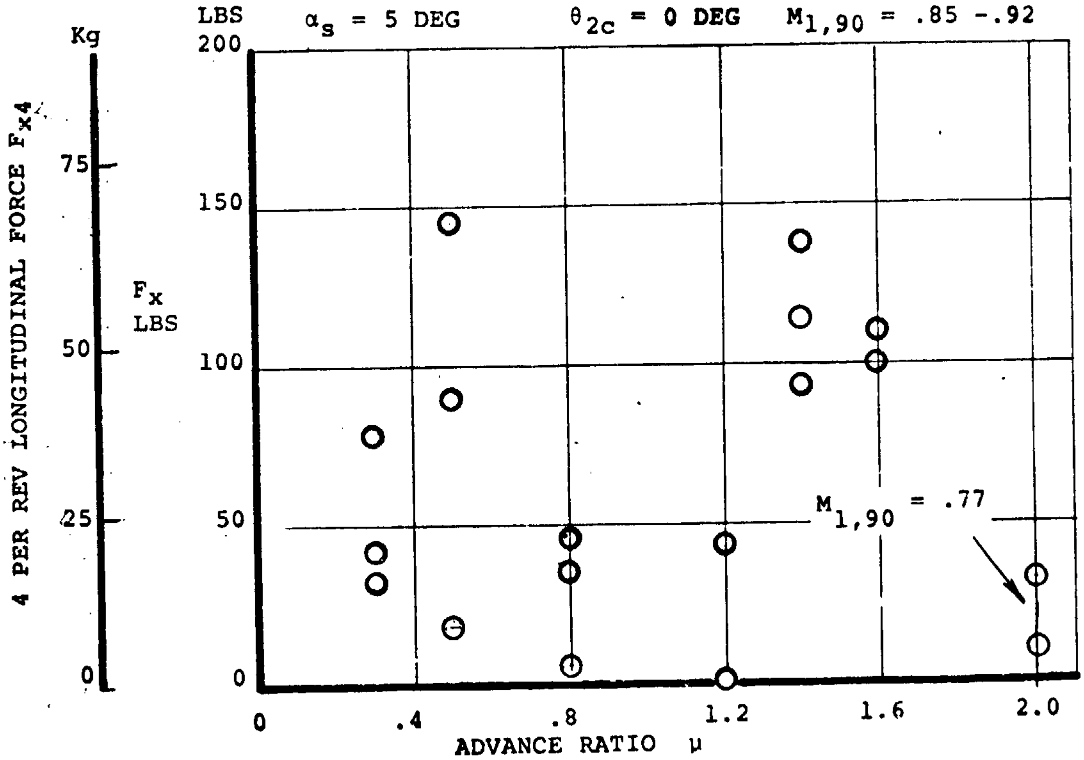


FIGURE 3.4 RVR WIND TUNNEL MODEL 4 PER REV FIXED SYSTEM LONGITUDINAL FORCE FOR 5 DEG AFT SHAFT TILT AND ZERO 2 PER REV CYCLIC (ROTATING HUB BALANCE DATA)

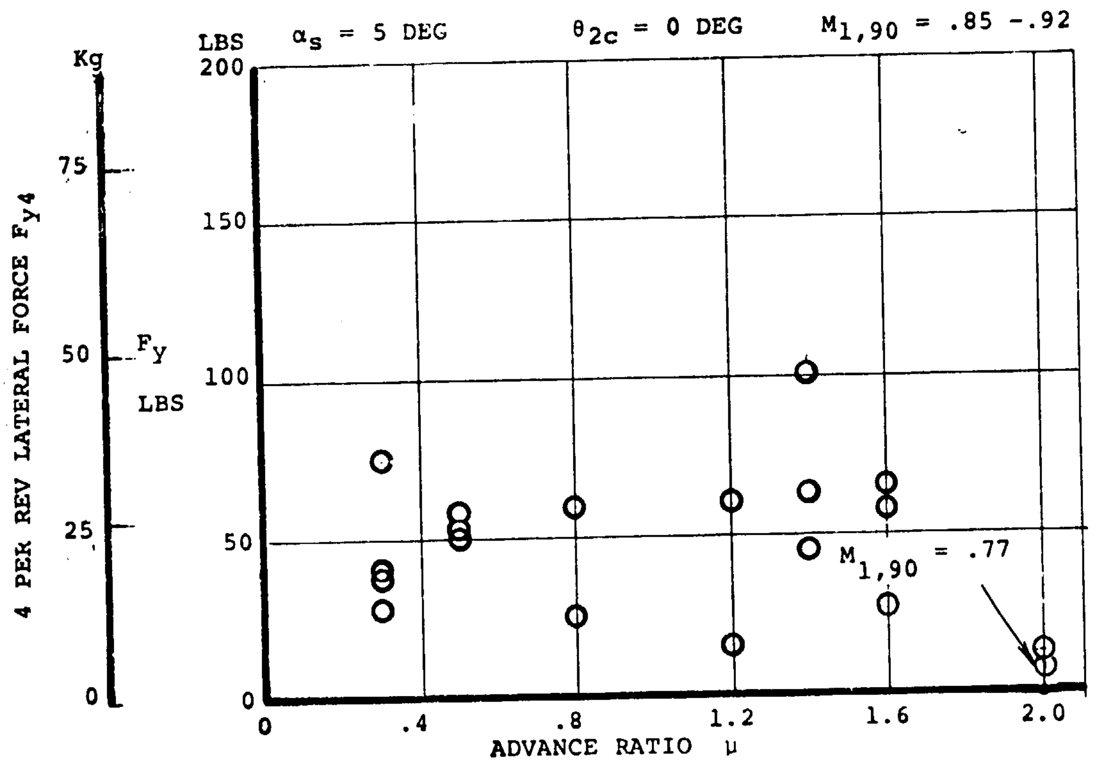


FIGURE 3.5 RVR WIND TUNNEL MODEL 4 PER REV FIXED SYSTEM LATERAL FORCE FOR 5 DEG AFT SHAFT TILT AND ZERO 2 PER REV CYCLIC (ROTATING HUB BALANCE DATA)

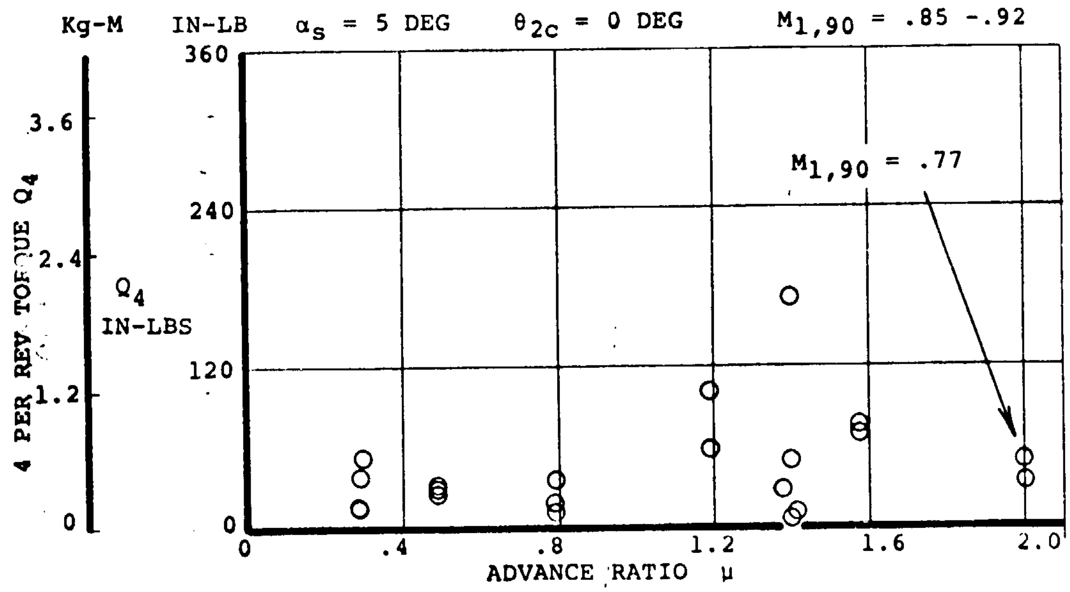


FIGURE 3.6 RVR WIND TUNNEL MODEL 4 PER REV FIXED SYSTEM TORQUE FOR 5 DEG AFT SHAFT TILT AND ZERO 2 PER REV CYCLIC (ROTATING HUB BALANCE DATA)

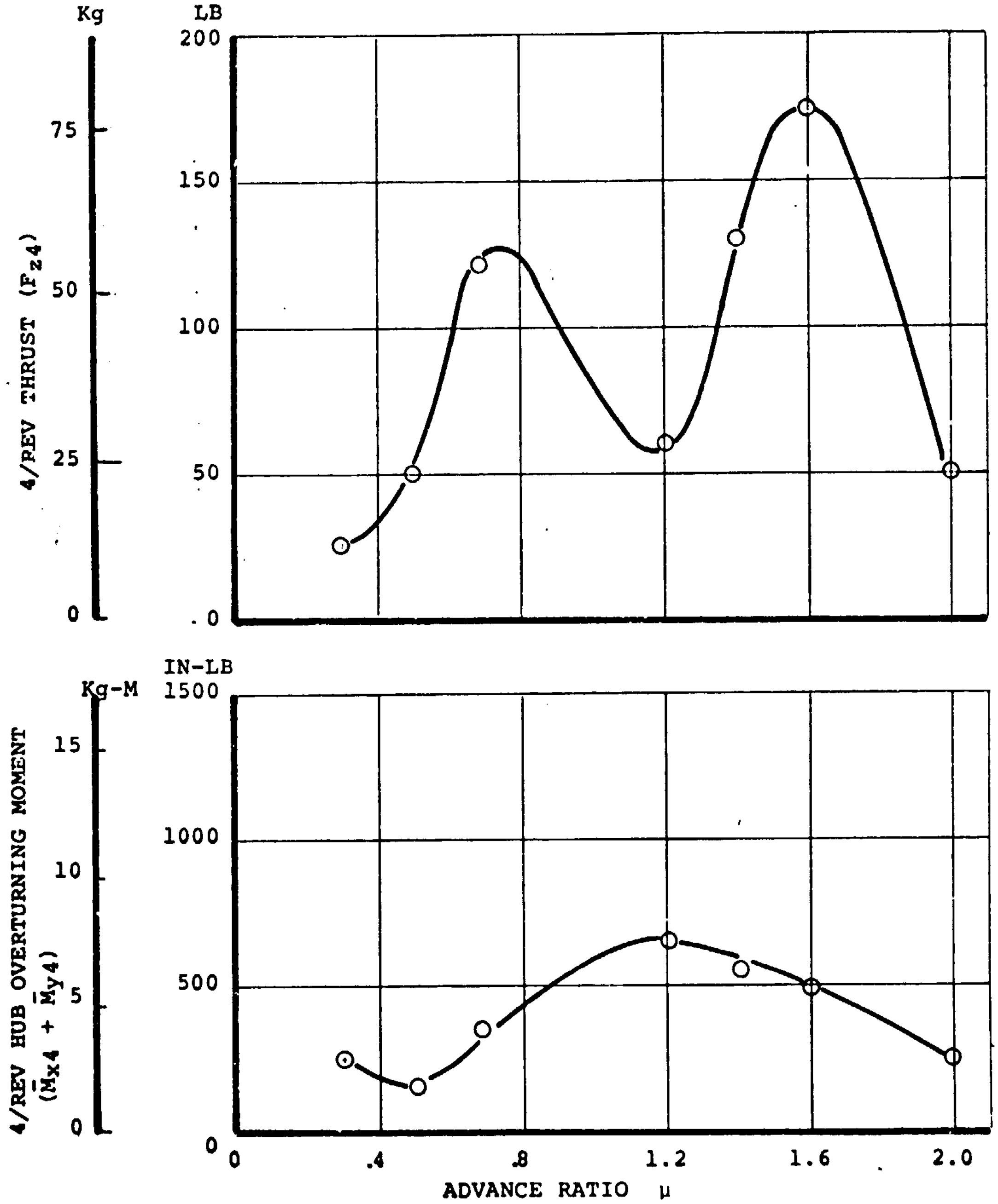


FIGURE 3.7 RVR WIND TUNNEL MODEL MEASURED 4 PER REV FIXED SYSTEM HUB LOADS FOR ZERO 2 PER REV CYCLIC AND 1G LIFT (ROTATING HUB BALANCE DATA)

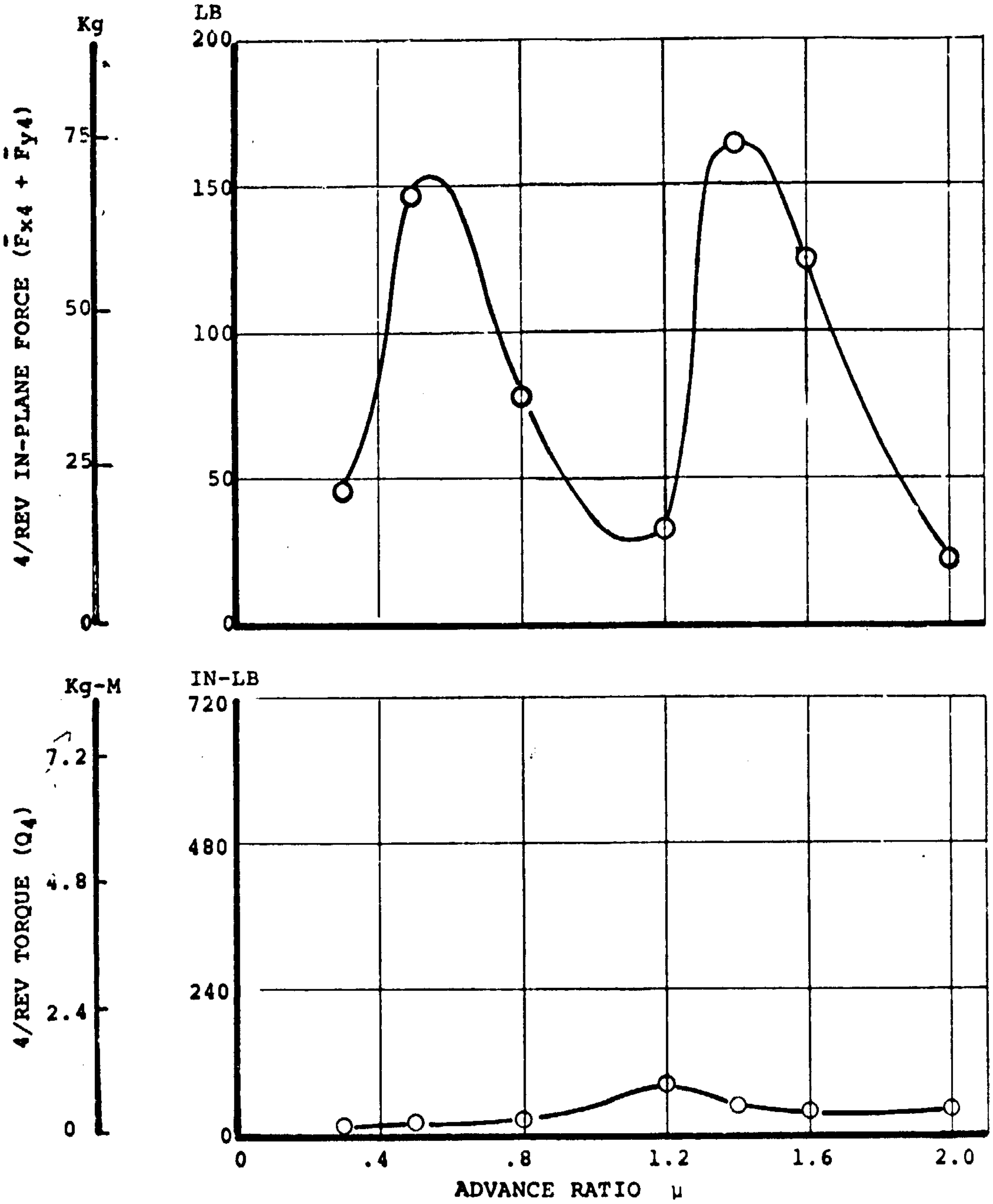


FIGURE 3.8 RVR WIND TUNNEL MODEL MEASURED 4 PER REV FIXED SYSTEM HUB LOADS FOR ZERO 2 PER REV CYCLIC AND 1G LIFT (ROTATING HUB BALANCE DATA)

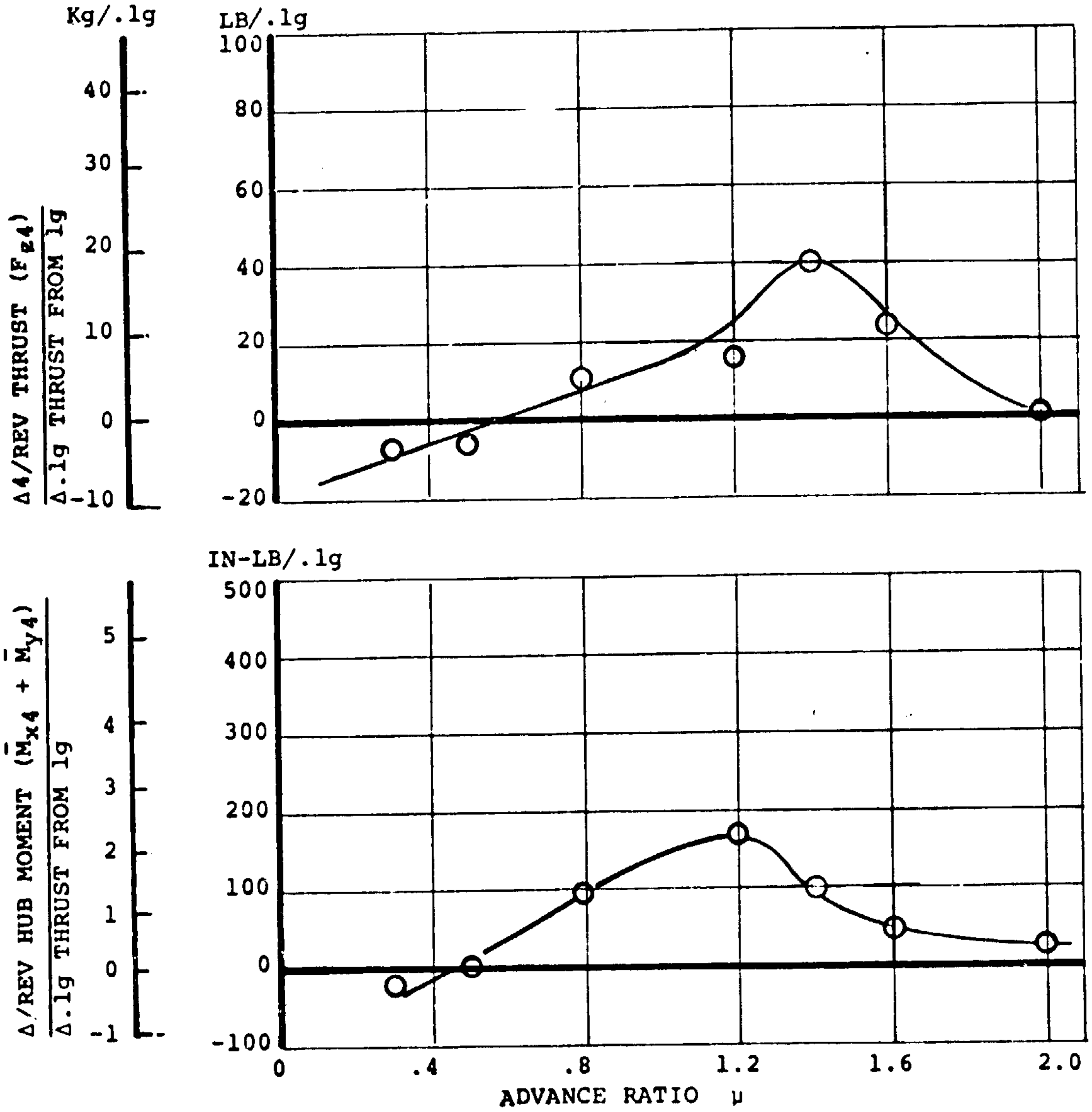


FIGURE 3.9 EFFECT OF G's THRUST ON 4/REV FIXED SYSTEM HUB LOADS (ROTATING HUB BALANCE DATA)

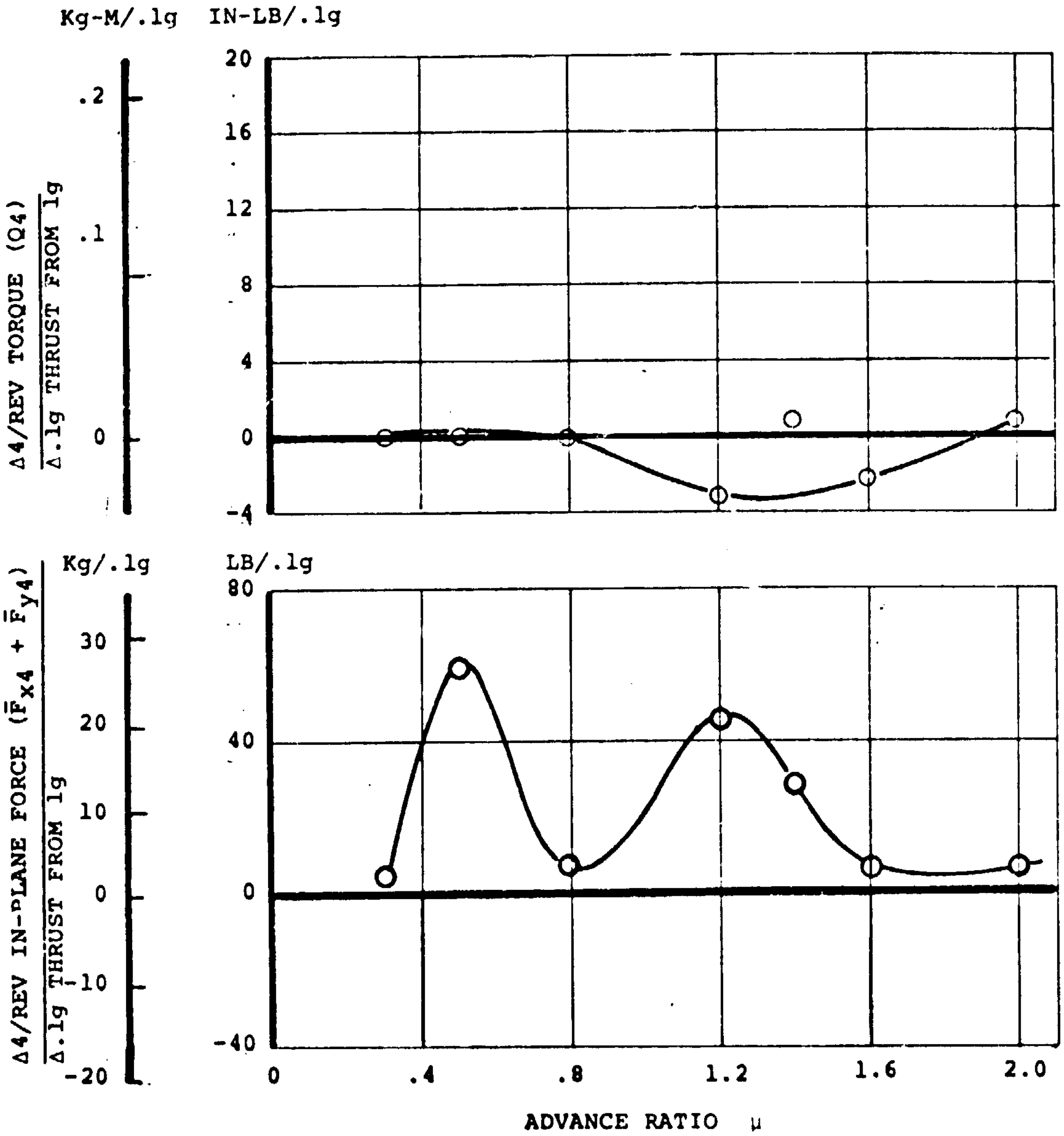


FIGURE 3.10 EFFECT OF G's THRUST ON 4/REV FIXED SYSTEM HUB LOADS (ROTATING HUB BALANCE DATA)

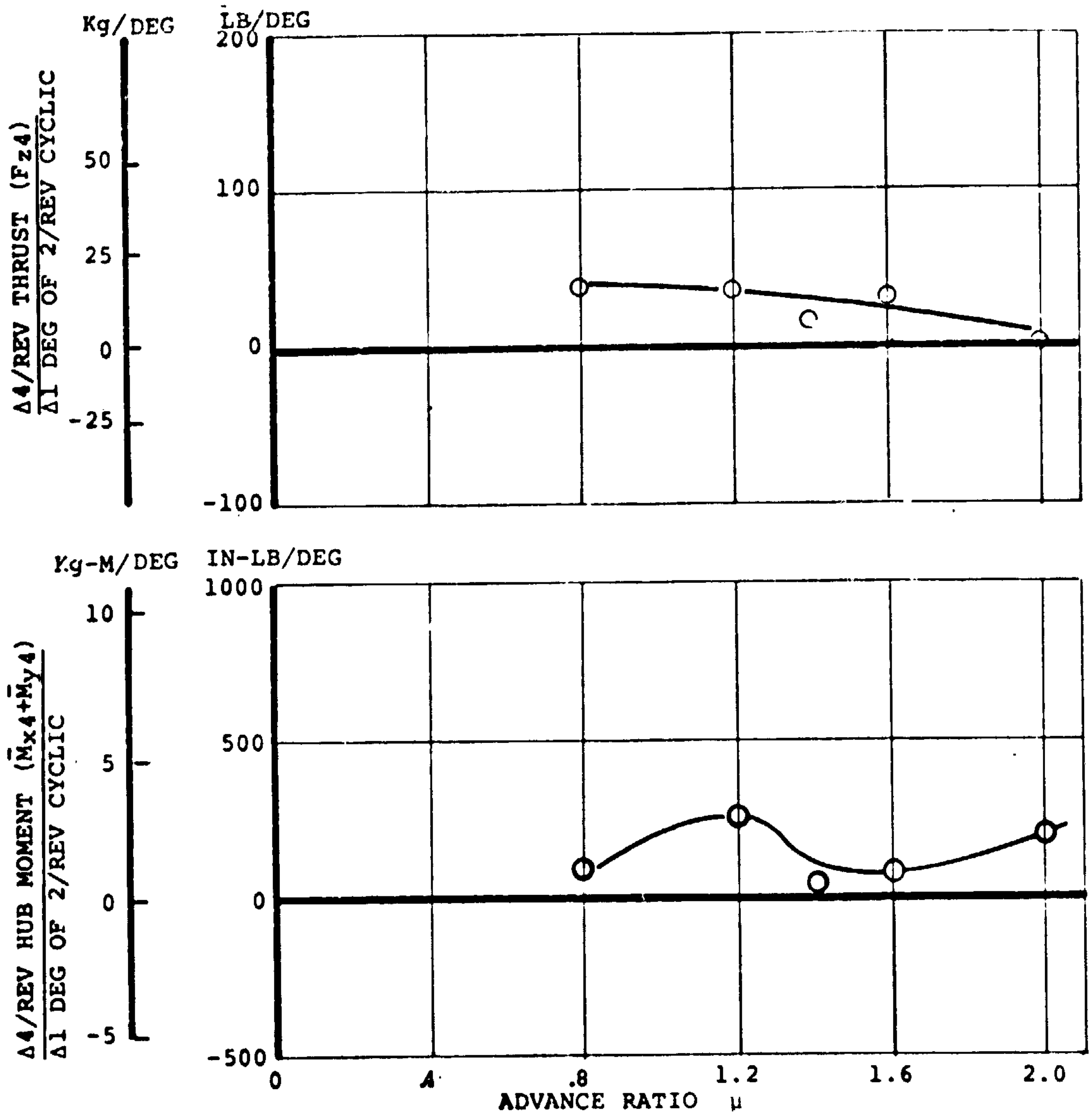


FIGURE 3.11 RVR WIND TUNNEL MODEL EFFECT OF 2 PER REV CYCLIC ON MEASURED 4 PER REV FIXED SYSTEM HUB LOADS (ROTATING HUB BALANCE DATA)

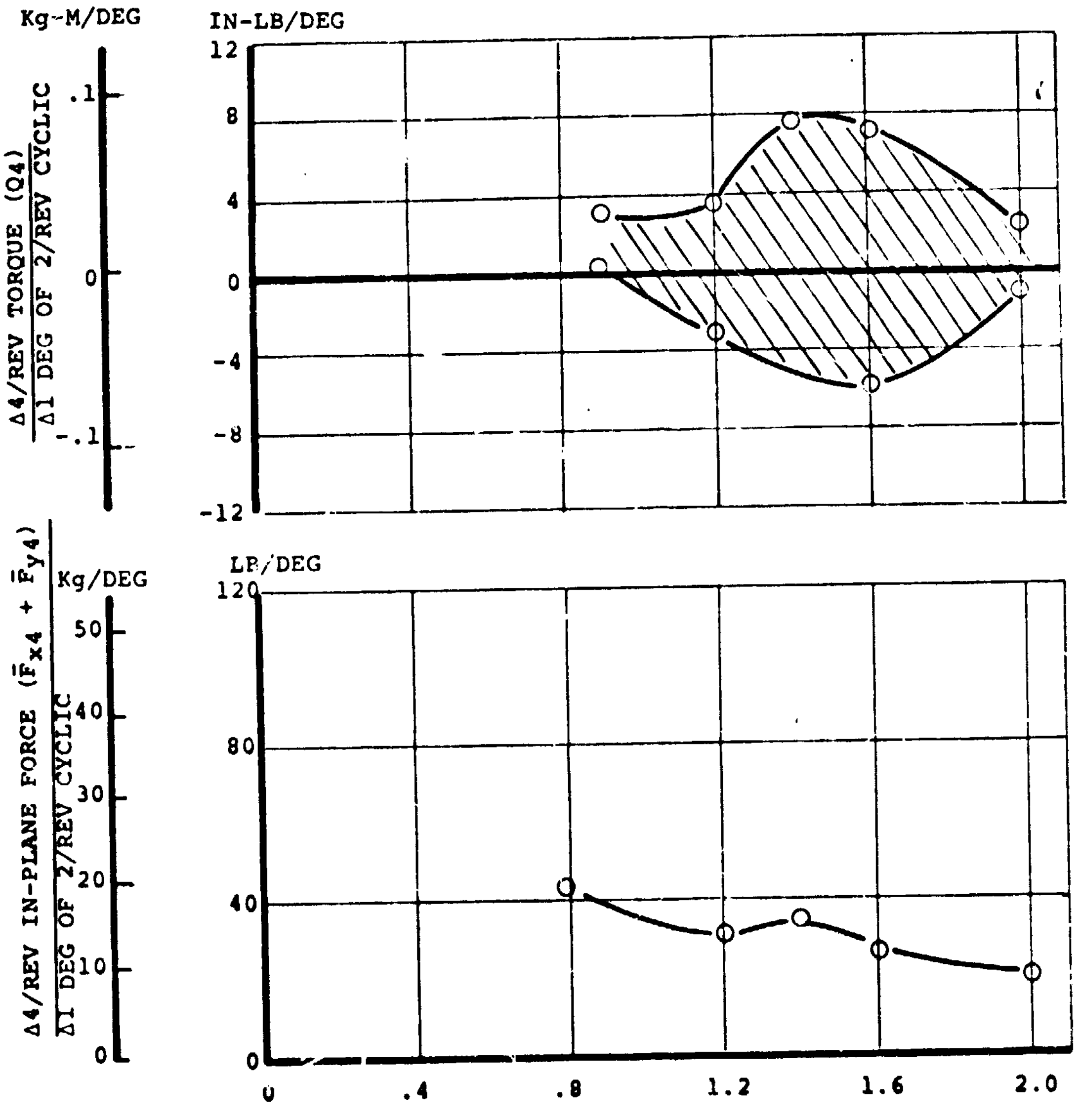


FIGURE 3.12 RVR WIND TUNNEL MODEL EFFECT OF 2 PER REV CYCLIC ON MEASURED 4 PER REV FIXED SYSTEM HUB LOADS (ROTATING HUB BALANCE DATA)

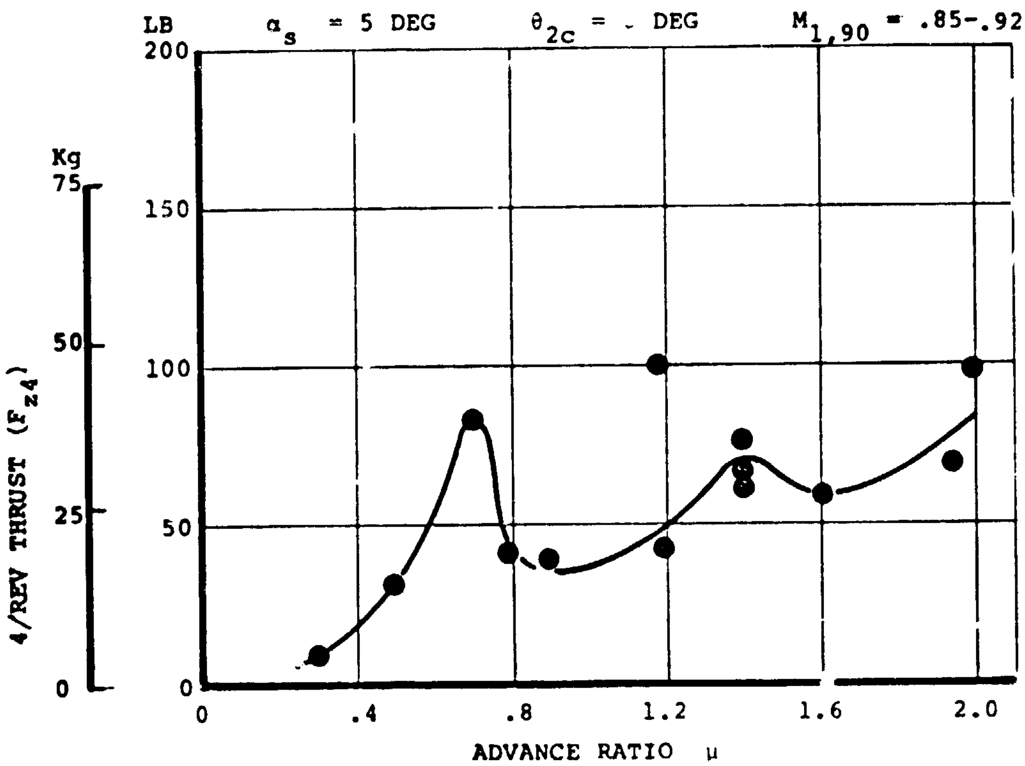


FIGURE 3.13 RVR WIND TUNNEL MODEL 4/REV FIXED SYSTEM HUB THRUST (OBTAINED FROM GENERALIZED COORDINATES)

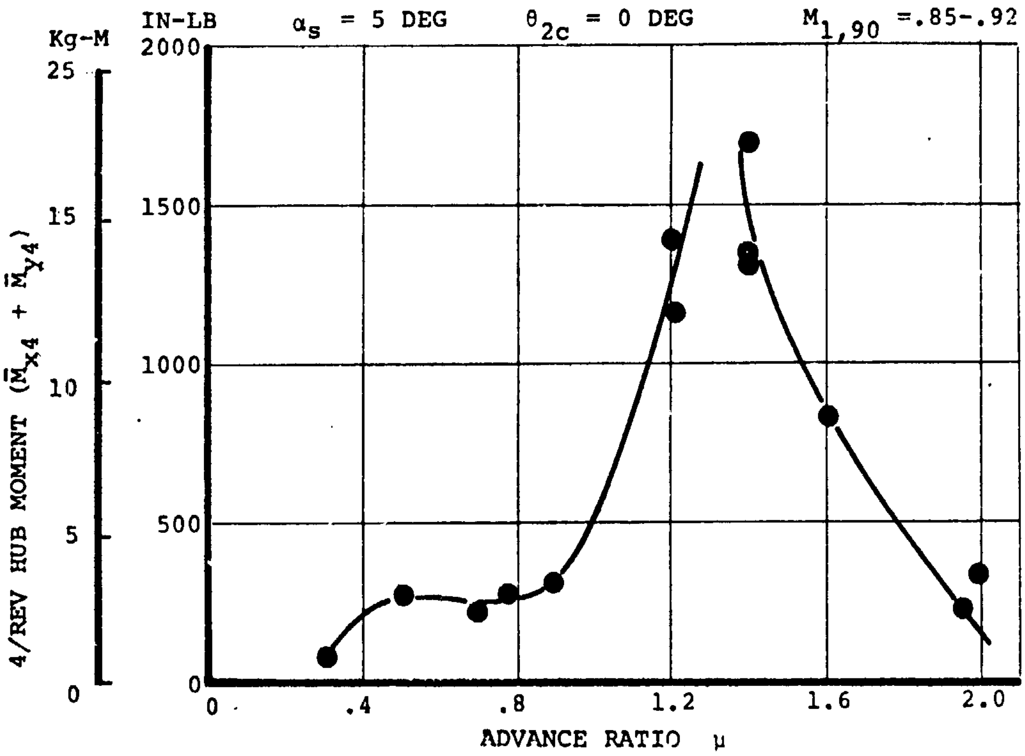


FIGURE 3.14 RVR WIND TUNNEL MODEL 4/REV FIXED SYSTEM HUB OVERTURNING MOMENT (OBTAINED FROM GENERALIZED COORDINATES)

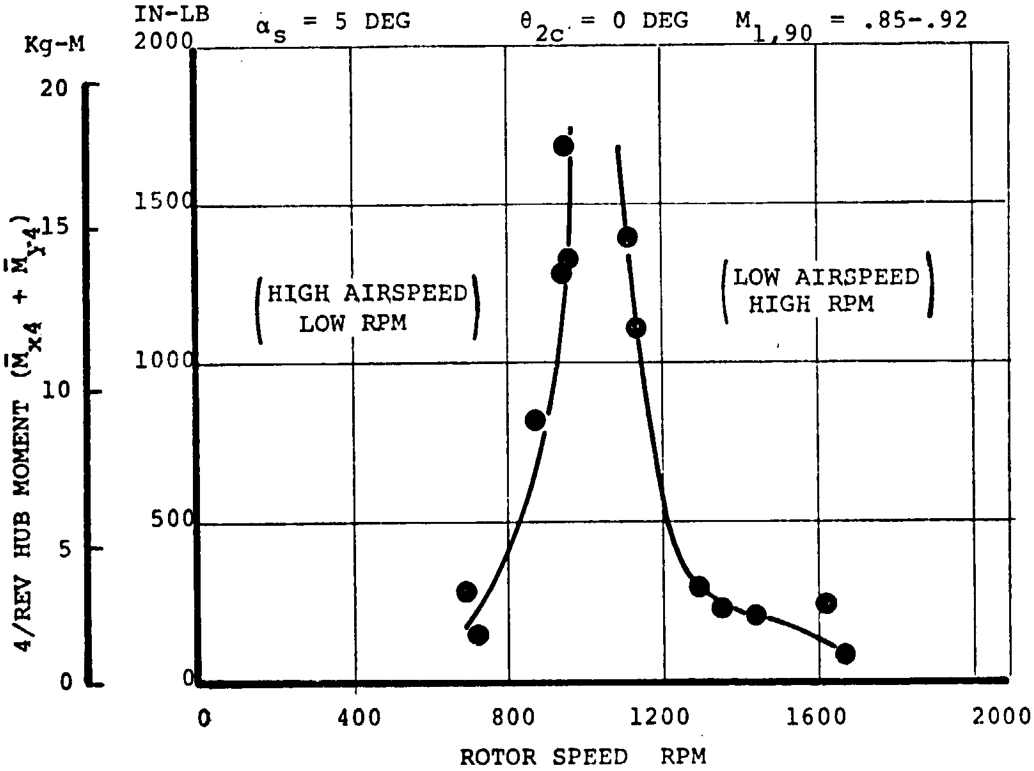


FIGURE 3.15 RVR WIND TUNNEL MODEL 4/REV FIXED SYSTEM HUB OVERTURNING MOMENT VARIATION WITH ROTOR SPEED (OBTAINED FROM GENERALIZED COORDINATES)

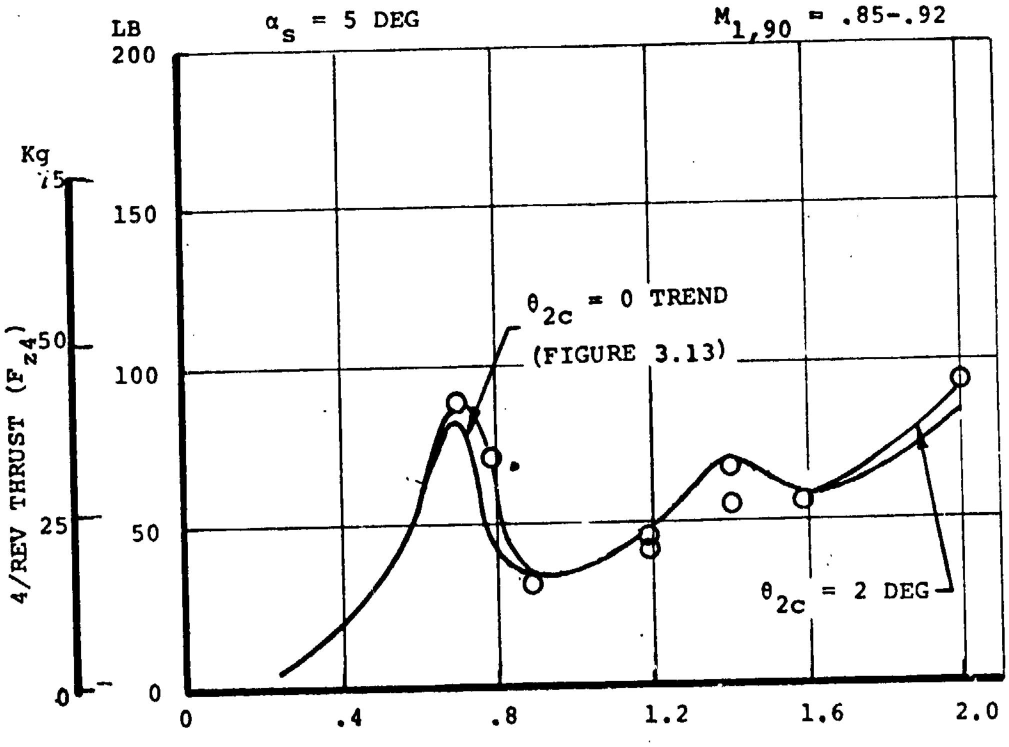


FIGURE 3.16 RVR WIND TUNNEL MODEL EFFECT OF 2 PER REV CYCLIC ON 4 PER REV FIXED SYSTEM HUB THRUST (OBTAINED FROM GENERALIZED COORDINATES)

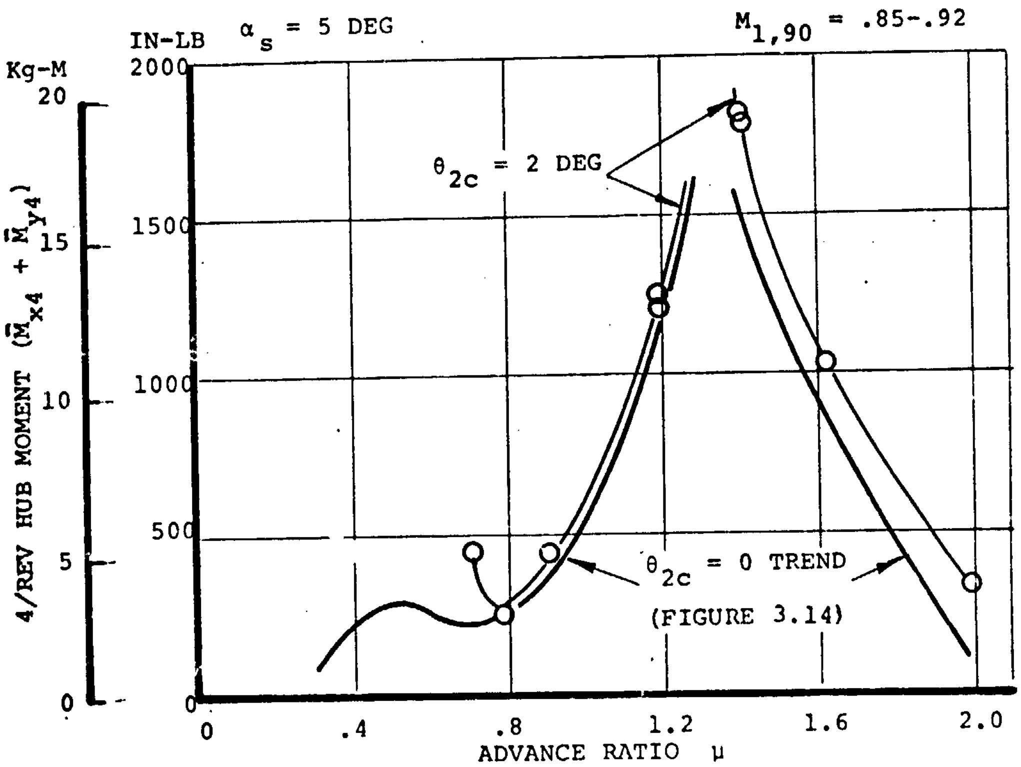


FIGURE 3.17 RVR WIND TUNNEL MODEL EFFECT OF 2 PER REV CYCLIC ON 4 PER REV FIXED SYSTEM HUB OVERTURNING MOMENT (OBTAINED FROM GENERALIZED COORDINATES)

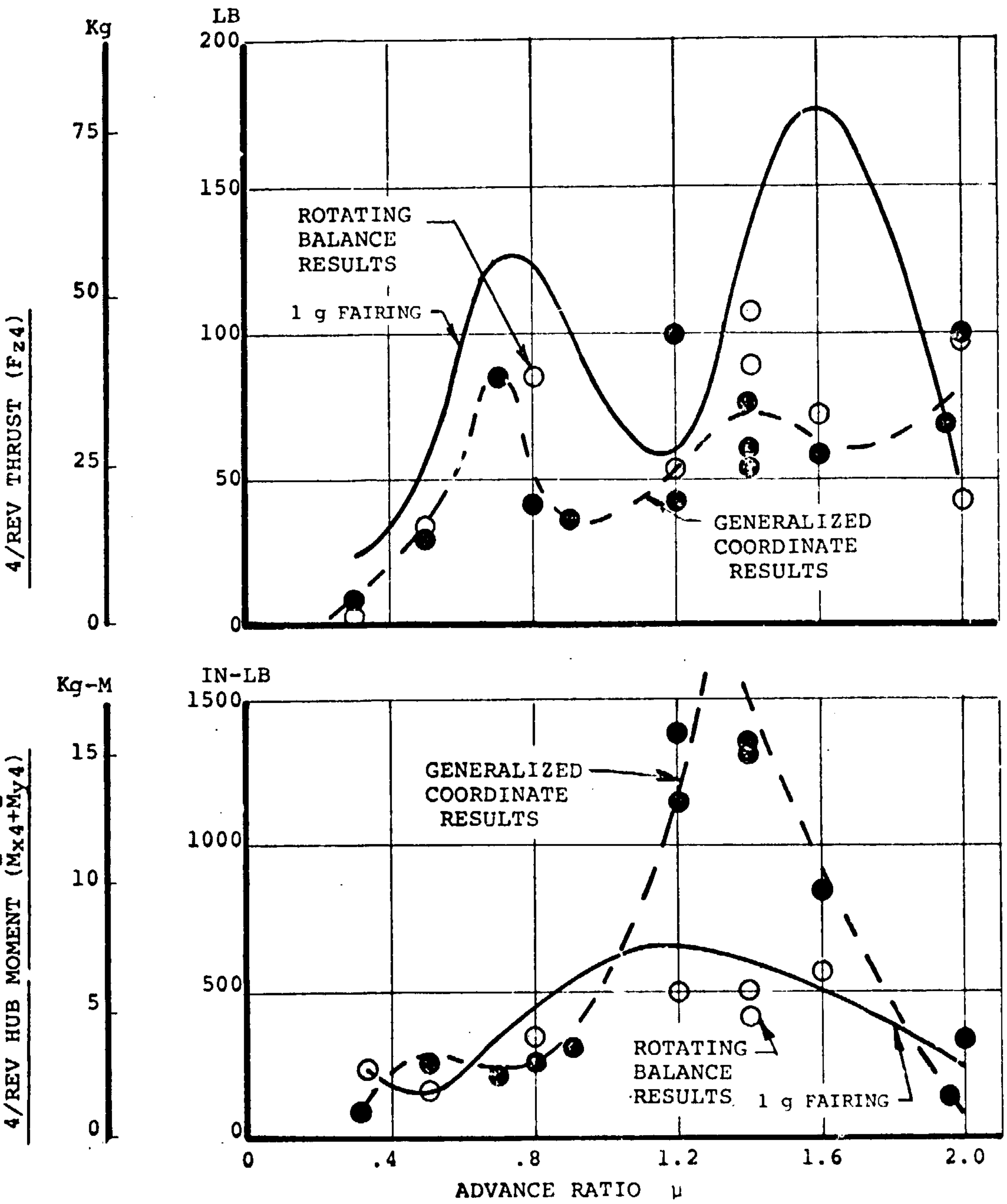


FIGURE 3.18 RVR WIND TUNNEL MODEL COMPARISON OF 4 PER REV FIXED SYSTEM HUB LOADS FOR ZERO 2 PER REV CYCLIC AND 1g LIFT OBTAINED FROM ROTATING BALANCE AND FROM GENERALIZED COORDINATES

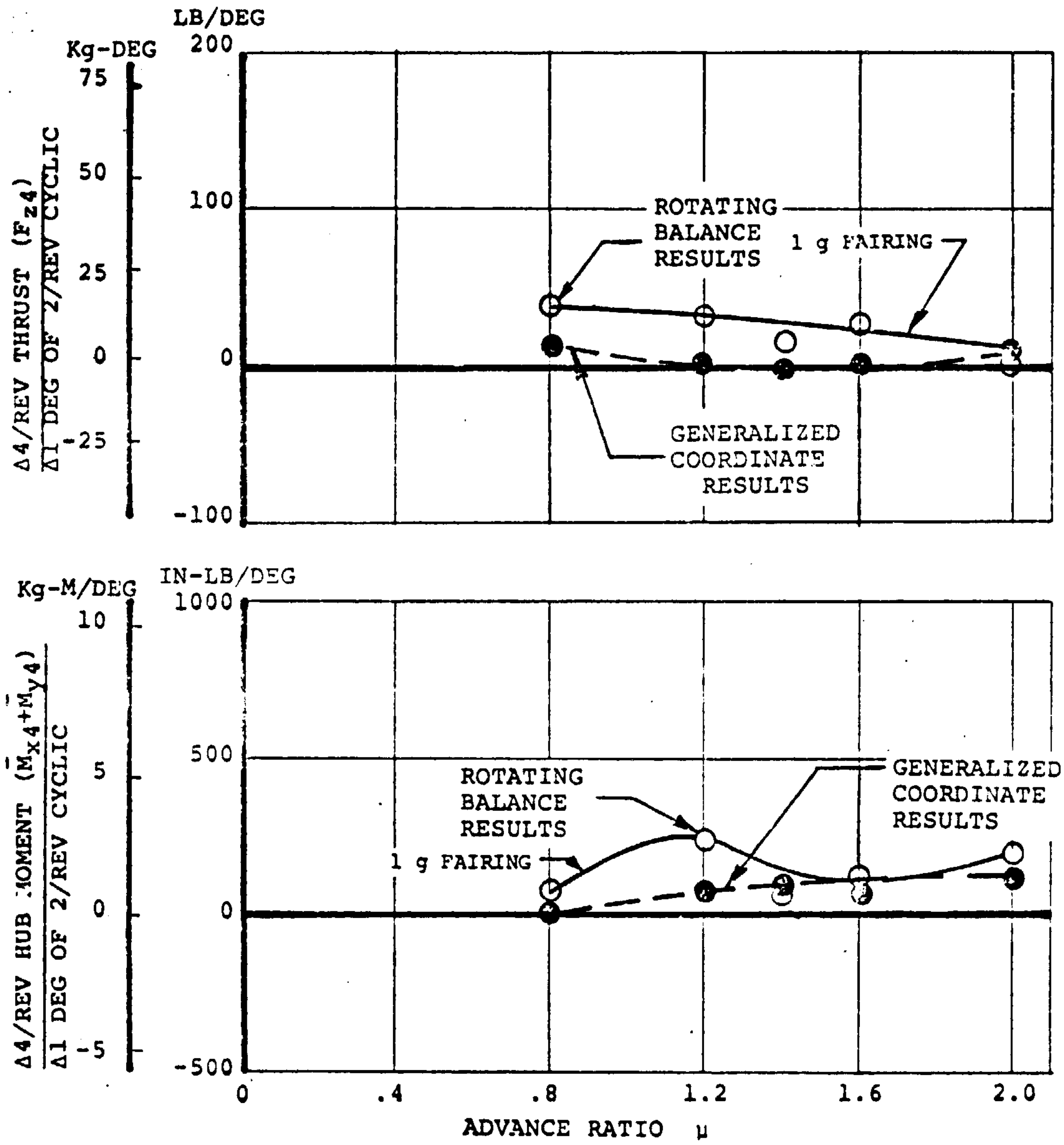


FIGURE 3.19 RVR WIND TUNNEL MODEL COMPARISON OF EFFECT OF 2 PER REV CYCLIC ON 4 PER REV FIXED SYSTEM HUB LOADS AS OBTAINED FROM ROTATING BALANCE AND FROM GENERALIZED COORDINATES

4.0 CONCLUSIONS

Conclusions drawn from the results shown in Section 3 are limited to the three hub loads components (F_z, M_x and M_y) for which data from both methods (rotating balance and generalized coordinates) are available.

1. Both the rotating balance method and the generalized coordinate method can be used to compute vibratory hub loads for a model rotor. Both methods are readily applicable to model test data given some pertinent information about the model, such as geometry and blade dynamic characteristics. The most significant unknown is the dynamic characteristics of the model/test stand and how they affect the hub loads through inertial loading.

2. Comparison of results between the rotating balance method and the generalized coordinate method shows poor correlation for both vibratory thrust and hub overturning moment. There are different reasons for the disparity in results in each case. For vibratory thrust the rotating balance results seem quite sensitive to model/test stand resonance conditions at different rotor speeds across the advance ratio range. A model longitudinal mode is suspected as the source of 2 peaks in the rotating balance thrust results but the mechanism of interaction is not understood. For advance ratios removed from these resonance conditions, the agreement between rotating balance results and generalized coordinates results are good.

The generalized coordinate results for vibratory thrust show some sensitivity to one of these peaks at the lower advance ratio (μ=.7). Thereafter, a nearly linear trend, increasing with advance ratio, is exhibited with a suppressed peak at μ=1.4. The effect of these resonance points on the rotating balance results is believed to obscure the actual thrust results across the advance ratio range. The implication from this is that model/test stand resonances are important considerations when attempting to measure hub loads since both quantitative and qualitative results are directly connected to the model/test stand dynamic characteristics.

For vibratory hub overturning moment, results from both methods agree at low and high advance ratios. At advance ratios between 1.0 and 1.6, the disagreement in the results is again due to a resonance point, but the source of resonance is quite different from the thrust results. The primary source of hub moment forcing is the 3/rev resonance point for the first flexible flapwise mode (2nd flap mode). This resonance occurs as a result of reducing the rotor speed to increase advance ratio to obtain the desired test condition. This is a natural characteristic of articulated rotors and not connected to the model/test stand modes previously discussed. The generalized coordinate results show an extremely high sensitivity to this 3/rev crossing. An estimation of the damping (assuming a second order spring mass damper system) is about 4% which is close to that predicted (3%) for the first flexible flap mode. The rotating balance hub moment results exhibit a damping on the order of 30 percent. Substantial damping in pitch and roll is being obtained by the model balance that is not evident in the blade flap modes, and this damping is probably peculiar to this particular model.

3. Analysis of the results and the conclusions above indicate the generalized coordinate method would be the most reliable way of obtaining hub loads. The apparent advantage of minimizing model/test stand dynamic interaction is the strongest reason for recommendation since the complications of attempting to account for these inertial effects is avoided. Also, the complexity of load measurement is reduced with the generalized coordinate method from a 6 component balance in the rotating system plus pitch links and the aforementioned inertial load measurements to blade bending moment gages. For a four bladed rotor, 10 measurements are required for 6 component hub loads compared to 6 blade bending gages (3 flap and 3 chord) for the generalized coordinate method.

4. Analysis of the results indicate that 2 separate vibration trends can be expected for a 4 bladed RVR rotor system. First, 4 per rev thrust will steadily increase with increasing airspeed. Vibratory thrust at μ=2.0 is roughly 4 times that at μ=.4. Secondly, 4 per rev hub moment is directly associated with proximity to the first flexible flap mode frequency at 3/rev. High 4/rev hub moments result from this close proximity while hub moments at μ=2.0 are equal or lower in magnitude to loads at μ=.4.

5.0 REFERENCES

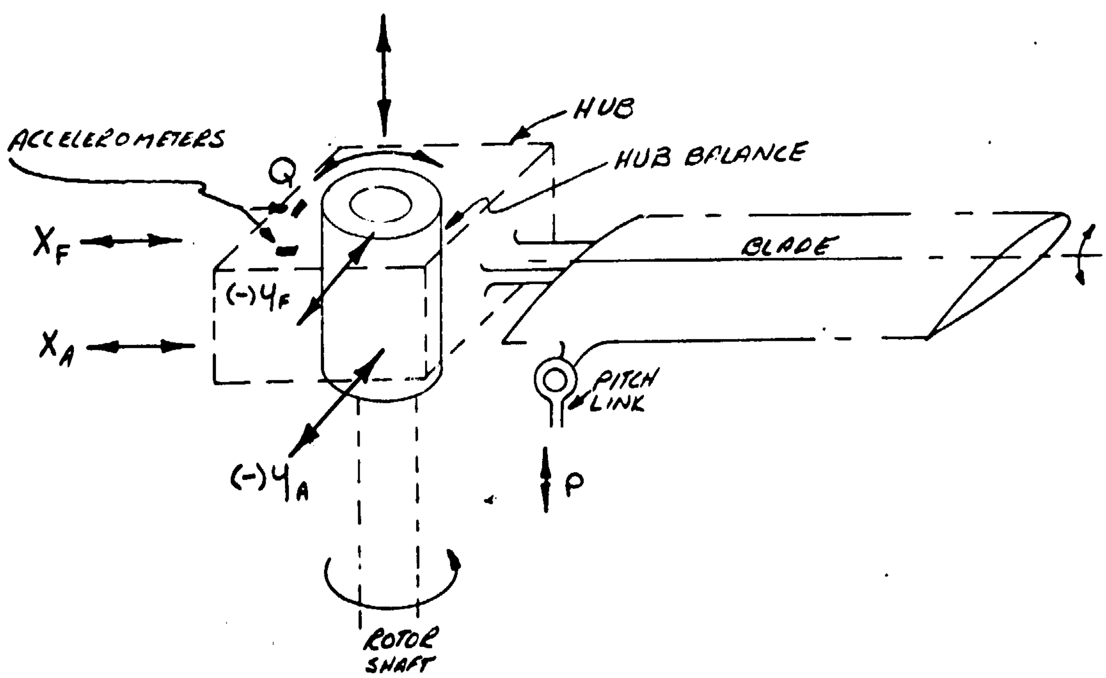
1. HELICOTPER VIBRATION REDUCTION WITH PENDULUM ABSORBERS, American Helicopter Society Journal, Vol 2, No 3, July 1975, R. Taylor and P. Teare.

2. FURTHER MODEL WIND TUNNEL TESTS OF A REVERSE VELOCITY ROTOR SYSTEM, Fairchild Republic Company Report HC171R1089, J. R. Ewans, F. J. McHugh, R. P. Seagrist, R. B. Taylor.

3. MODEL WIND TUNNEL TESTS OF A REVERSE VELOCITY ROTOR SYSTEM, Fairchild Republic Company Report HC144R1070, J. R. Ewans and T. A. Krauss.

APPENDIX A - ROTATING HUB BALANCE DATA REDUCTION EQUATIONS

Reduction of the dynamic data obtained from the hub balance was performed by NASA. The computer program utilized was written by Ron Smith, NASA Test Project Engineer, and is presented in this section.



Dynamic Hub Balance	-	6 Components
Accelerometers	-	3 Components
Pitch Link Load	-	1 Component

These 10 components of data were recorded on analog magnetic tape which was then analyzed by taking the direct Fourier transform on the TD90. TD90 creates a digital tape compatible with the IBM 360 which will perform the following operations:

TD90 Tape Variables

x_F''	$\equiv$	Upper Longitudinal Force, cts
x_A''	$\equiv$	Lower " " "
y_F''	$\equiv$	Upper Side " "
y_A''	$\equiv$	Lower " " "
T''	$\equiv$	Thrust " "
Q''	$\equiv$	Shaft Torque, "
a_x''	$\equiv$	Longitudinal Acceleration "
a_y''	$\equiv$	Side " "
a_T''	$\equiv$	Vertical " "
P''	$\equiv$	Pitch Link Force "

There are 28 values in sequence for each of these 10 variables in one record. Each value is associated with a different value of the subscript i (i = 1, 28). The subscript i will be inferred in the following data reduction equations; hence, in general, each indicated operation will be done 28 times for each data record

TD90 Tape Record Format

HARMONIC →	D.C.	1P	2P	3P	------	13P	(REAL PART)
i →	1	2	3	4	------	14	
HARMONIC →	D.C.	1P	2P	3P	------	13P	(IMAG.PART)
i →	15	16	17	18	------	28	

Conversion to Physical Units

$$(x'_F)_{LB} = \frac{K_{XF}}{(CAL.RDG.)_{cts}} (X''_F)_{cts}$$

$$(x'_A)_{LB} = \frac{K_{XA}}{(CAL.RDG.)_{cts}} (X''_A)_{cts}$$

NOTE: CAL.RDGS. will be found in location $i = 2$ of the "CAL." record.

$$(y'_F)_{LB} = \frac{K_{YF}}{(CAL.RDG.)_{cts}} (Y''_F)_{cts}$$

$$(y'_A)_{LB} = \frac{K_{YA}}{(CAL.RDG.)_{cts}} (Y''_A)_{cts}$$

$$T')_{LB} = \frac{K_T}{(CAL.RDG.)_{cts}} (T'')_{cts}$$

$$(Q')_{FT-LB} = \frac{K_Q}{(CAL.RDG.)_{cts}} (Q'')_{cts}$$

$$(a_x)_{G's} = \frac{K_{ax}}{(CAL.RDG.)_{cts}} (a''_x)_{cts}$$

$$(a_y)_{G's} = \frac{K_{ay}}{(CAL.RDG)_{cts}} (a''_y)_{cts}$$

$$(a_T)_{G's} = \frac{K_{aT}}{(CAL.RDG.)_{cts}} (a''_T)_{cts}$$

$$(P)_{LB} = \frac{K_P}{(CAL.RDG.)_{cts}} (P'')_{cts}$$

Definition of Forces and Moments in Rotating System

Balance Forces:

$(x_F)_{LB} = (x'_F)_{LB}$ + Interaction Corr.

$(x_A)_{LB} = (x'_A)_{LB}$ + " "

$(y_F)_{LB} = (y'_F)_{LB}$ + Interaction Corr.

$(y_A)_{LB} = (y'_A)_{LB}$ + " "

$(T)_{LB} = (T')_{LB}$ + " "

$(Q)_{FT-LB} = (Q)_{FT-LB}$ + " "

Iterate for Interactions in the Usual Manner

<u>Inertial Force Corrections</u>

$$(I_x)_{LB} = (a_x)_{G's}\,(W_H)_{LB}$$

$$(I_y)_{LB} = (a_y)_{G's}\,(W_H)_{LB}$$

$$(I_T)_{LB} = (a_T)_{G's}\,(W_V)_{LB}$$

<u>Corrected Balance Forces</u>:

$$x = (x_F)_{LB} + (x_A)_{LB} + (I_x)_{LB}$$

$$y = (y_F)_{LB} + (y_A)_{LB} + (I_y)_{LB}$$

$$T = (T)_{LB} + (I_T)_{LB}$$

$$m = \ell_x\,[(x_A)_{LB} - (x_F)_{LB}]$$

$$\ell = \ell_y\,[(y_F)_{LB} - (y_A)_{LB}]$$

$$Q = (Q)_{FT-LB}$$

<u>Constants</u>

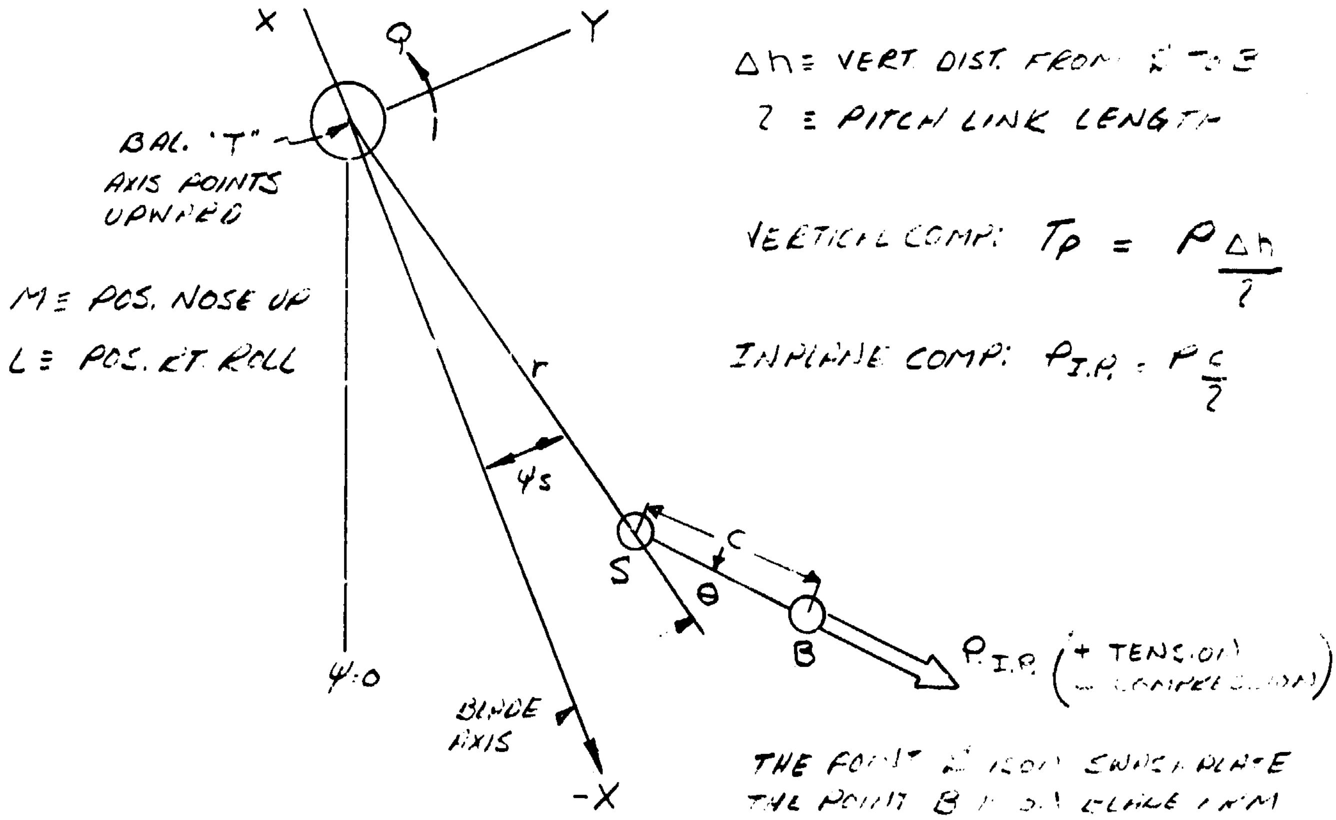
$\ell_x \equiv$ Dist. from Bal. Ctr. to "x" gage

$\ell_y \equiv$ " " " " " " "

$W_H \equiv$ Weight of Rotor incl. Blades

$W_L \equiv$ Effective Weight of Rotor in Vertical Direction

Resolution of Pitch Link Components



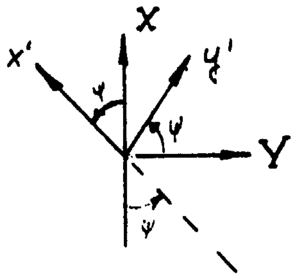
Pitch Link Force & Moment Components

$$X_P = -P\frac{c}{l}\cos(\psi_s+\theta)$$
$$Y_P = P\frac{c}{l}\sin(\psi_s+\theta)$$
$$T_P = P\frac{\Delta h}{l}$$
$$Q_P = Y_P(r+c\cos\theta)+X_P(r\sin\psi_s+c\sin\theta)$$
$$M_P = -T_P(r+c\cos\theta)$$
$$L_P = -T_P(r\sin\psi_s+c\sin\theta)$$

$\frac{c}{l}$, $\frac{\Delta h}{l}$, ψ_s & θ ARE CONST.

NOTE: - Assumes no significant dynamic deviation of geometric relationships. (i.e. θ, c & Δh assumed const.)

Transformation of Rotating Forces to Fixed Frame



(sign convention conforms to Gessow & Mayers)

LONGITUDINAL FORCE

$$X = x \cos \psi + y' \sin \psi$$

LATERAL FORCE

$$Y = y' \cos \psi - x \sin \psi$$

4P Resultant Forces (3P & 5P in Rotat. Sys.)

We will use the trig. identities:

$$\cos n\psi \cos \psi = \tfrac{1}{2}\left[\cos(n+1)\psi + \cos(n-1)\psi\right]$$

$$\cos n\psi \sin \psi = \tfrac{1}{2}\left[\sin(n+1)\psi - \sin(n-1)\psi\right]$$

$$\sin n\psi \sin \psi = \tfrac{1}{2}\left[\cos(n-1)\psi - \cos(n+1)\psi\right]$$

$$\sin n\psi \cos \psi = \tfrac{1}{2}\left[\sin(n+1)\psi + \sin(n-1)\psi\right]$$

The components of 4P in fixed fram due to 3P & 5P in the rotating system will be kept separated so that reference can be made as to the origin of the force.

4 Blade Rotor - all resultant harmonics but 4P, 8P, 12P

will be filtered out.

<u>LONGITUDINAL FORCE</u>, X

4P DUE TO 3P: $$X_3 = X_{c_3} \cos 3\psi \cos\psi + X_{s_3} \sin 3\psi \cos\psi + Y_{c_3} \cos 3\psi \sin\psi + Y_{s_3} \sin 3\psi \sin\psi$$

$$= \frac{X_{c_3}}{2} \cos 4\psi + \frac{X_{s_3}}{2} \sin 4\psi + \frac{Y_{c_3}}{2} \sin 4\psi - \frac{Y_{s_3}}{2} \cos 4\psi$$

$$\underline{X_3 = \tfrac{1}{2}(X_{c_3} - Y_{s_3}) \cos 4\psi + \tfrac{1}{2}(X_{s_3} + Y_{c_3}) \sin 4\psi}$$

4P due to 5P:

$$X_5 = X_{c_5} \cos 5\psi \cos\psi + X_{s_5} \sin 5\psi \cos\psi - Y_{c_5} \cos 5\psi \sin\psi + Y_{s_5} \sin 5\psi \sin\psi$$

$$= \frac{X_{c_5}}{2} \cos 4\psi + \frac{X_{c_5}}{2} \sin 4\psi - \frac{Y_{c_5}}{2} \sin 4\psi + \frac{Y_{s_5}}{2} \cos 4\psi$$

$$\underline{X_5 = \tfrac{1}{2}(X_{c_5} + Y_{s_5}) \cos 4\psi + \tfrac{1}{2}(X_{s_5} - Y_{c_5}) \sin 4\psi}$$

Similarly, the 8P and 12P resultant forces are found to be:

8P DUE TO 7P:

$$X_7 = \tfrac{1}{2}(X_{c_7} - Y_{s_7}) \cos 8\psi + \tfrac{1}{2}(X_{s_7} + Y_{c_7}) \sin 8\psi$$

8P DUE TO 9P:

$$X_9 = \tfrac{1}{2}(X_{c_9} + Y_{s_9}) \cos 8\psi + \tfrac{1}{2}(X_{s_9} - Y_{c_9}) \sin 8\psi$$

LONG. FORCE (CONT)

12P DUE TO 11P:

$$X_{11} = 1/2\,(X_{C_1} - Y_{S_1}) \cos 12\psi + 1/2\,(X_{S_1} + Y_{C_1}) \sin 12\psi$$

12P DUE TO 12P:

$$X_{12} = 1/2\,(X_{C_{12}} + Y_{S_{12}}) \cos 12\psi + 1/2\,(X_{S_{12}} - Y_{C_{12}}) \sin 12\psi$$

LATERAL FORCE,

4P due to 3P: $$Y_3 = -X_{C_3} \cos 3\psi \sin\psi - X_{C_3} \sin 3\psi \sin\psi$$

$$+ Y_{C_3} \cos 3\psi \cos\psi + Y_{S_3} \sin 3\psi \cos\psi$$

$$= \frac{-X_{C_3}}{2} \sin 4\psi + 1/2\, X_{S_3} \cos 4\psi + \frac{Y_{C_3}}{2} \cos 4\psi + \frac{Y_{S_3}}{2} \sin 4\psi$$

$$\underline{Y_3 = 1/2\,(Y_{C_3} + X_{S_3}) \cos 4\psi + 1/2\,(-X_{C_3} + Y_{S_3}) \sin 4\psi}$$

4P due to 5P: $$Y_5 = -X_{C_5} \cos 5\psi \sin\psi - X_{S_5} \sin 5\psi \sin\psi$$

$$+ Y_{C_5} \cos 5\psi \cos\psi + Y_{S_5} \sin 5\psi \cos\psi$$

$$= \frac{+X_{C_5}}{2} \sin 4\psi - \frac{X_{S_5}}{2} \cos 4\psi + \frac{Y_{C_5}}{2} \cos 4\psi + \frac{Y_{S_5}}{2} \sin 4\psi$$

$$Y_5 = 1/2\,(Y_{S_5} - X_{C_5}) \cos 4\psi + 1/2\,(Y_{S_5} + X_{C_5}) \sin 4\psi$$

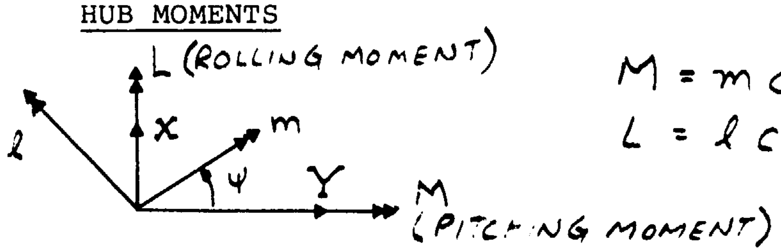
8P due to 7P: $Y_7 = \frac{1}{2}(y_{c_7} + x_{s_7}) \cos 8\psi + \frac{1}{2}(-x_{c_7} + y_{s_7}) \sin 8\psi$

8P due to 9P: $Y_9 = \frac{1}{2}(-x_{s_9} + y_{c_9}) \cos 8\psi + \frac{1}{2}(y_{s_9} + x_{c_9}) \sin 8\psi$

12P due to 11P: $Y_{11} = \frac{1}{2}(y_{c_{11}} + x_{s_{11}}) \cos 12\psi + \frac{1}{2}(-x_{c_{11}} + y_{s_{11}}) \sin 12\psi$

12P due to 13P: $Y_{13} = \frac{1}{2}(-x_{s_{13}} + y_{c_{13}}) \cos 12\psi + \frac{1}{2}(y_{s_{13}} + x_{c_{13}}) \sin 12\psi$

HUB MOMENTS



$$M = m \cos\psi - \ell \sin\psi$$
$$L = \ell \cos\psi + m \sin\psi$$

Notice that M is like Y with "m" for "y" and "ℓ" for "x".

Also L is like X. So we can use expressions for X and Y by replacing "y" with "m" and "x" with "ℓ".

Equations and IBM Output Format

The individual components of force and moment in the fixed system for a four bladed rotor are summarized in Table A-1 and A-2. Table A-1 defines the equations and the output format for the inplane components and Table A-2 defines the equations and output format for the vertical components.

ORIGINAL PAGE IS
OF POOR QUALITY

TABLE A-1 FORCES AND MOMENTS IN FIXED FRAME FOR A 4 BLADED ROTOR SYSTEM

EQUATIONS AND OUTPUT FORMAT FOR IN-PLANE COMPONENTS

SUBSCRIPTS DEFINED ON PAGE 74

FORCE \ HARMONIC NO.	3	5	7	9	11	13	
X_C	$\frac{1}{2}(x_{c3} - y_{s3})$	$\frac{1}{2}(x_{c5} + y_{s5})$	$\frac{1}{2}(x_{c7} - y_{s7})$	$\frac{1}{2}(x_{c9} + y_{s9})$	$\frac{1}{2}(x_{c11} - y_{s11})$	$\frac{1}{2}(y_{c13} + y_{s13})$	
X_S	$\frac{1}{2}(x_{s3} + y_{c3})$	$\frac{1}{2}(x_{s5} - y_{c5})$	$\frac{1}{2}(x_{s7} + y_{c7})$	$\frac{1}{2}(x_{s9} - y_{c9})$	$\frac{1}{2}(x_{s11} + y_{c11})$	$\frac{1}{2}(x_{s13} - y_{c13})$	
Y_C	X_{s3}	$-X_{s5}$	X_{s7}	$-X_{s9}$	X_{s11}	$-X_{s13}$	
Y_S	$-X_{c3}$	X_{c5}	$-X_{c7}$	X_{c9}	$-X_{c11}$	X_{c13}	
L_C	$\frac{1}{2}(\ell_{c3} - m_{s3})$	$\frac{1}{2}(\ell_{c5} + m_{s5})$	$\frac{1}{2}(\ell_{c7} - m_{s7})$	$\frac{1}{2}(\ell_{c9} + m_{s9})$	$\frac{1}{2}(\ell_{c11} - m_{s11})$	$\frac{1}{2}(\ell_{c13} + m_{s13})$	
L_S	$\frac{1}{2}(\ell_{s3} + m_{c3})$	$\frac{1}{2}(\ell_{s5} - m_{c5})$	$\frac{1}{2}(\ell_{s7} + m_{c7})$	$\frac{1}{2}(\ell_{s9} - m_{c9})$	$\frac{1}{2}(\ell_{s11} + m_{c11})$	$\frac{1}{2}(\ell_{s13} - m_{c13})$	
M_C	L_{s3}	$-L_{s5}$	L_{s7}	$-L_{s9}$	L_{s11}	$-L_{s13}$	
M_S	$-L_{c3}$	L_{c5}	$-L_{c7}$	L_{c9}	$-L_{c11}$	L_{c13}	
X_{PC}	$2(x_{Pc3} - y_{Ps3})$	$2(x_{Pc5} + y_{Ps5})$	$2(x_{Pc7} - y_{Ps7})$	$2(x_{Pc9} + y_{Ps9})$	$2(x_{Pc11} - y_{Ps11})$	$2(x_{Pc13} + y_{Ps13})$	
X_{PS}	$2(x_{Ps3} + y_{Pc3})$	$2(x_{Ps5} - y_{Pc5})$	$2(x_{Ps7} + y_{Pc7})$	$2(x_{Ps9} - y_{Pc9})$	$2(x_{Ps11} + y_{Pc11})$	$2(x_{Ps13} - y_{Pc13})$	
Y_{PC}	X_{Ps3}	$-X_{Ps5}$	X_{Ps7}	$-X_{Ps9}$	X_{Ps11}	$-X_{Ps13}$	
Y_{PS}	$-X_{Pc3}$	X_{Pc5}	$-X_{Pc7}$	X_{Pc9}	$-X_{Pc11}$	X_{Pc13}	
L_{PC}	$2(\ell_{Pc3} - m_{Ps3})$	$2(\ell_{Pc5} + m_{Ps5})$	$2(\ell_{Pc7} - m_{Ps7})$	$2(\ell_{Pc9} + m_{Ps9})$	$2(\ell_{P11} - m_{Ps11})$	$2(\ell_{Pc13} + m_{Ps13})$	
L_{PS}	$2(\ell_{Ps3} + m_{Pc3})$	$2(\ell_{Ps5} - m_{Pc5})$	$2(\ell_{Ps7} + m_{Pc7})$	$2(\ell_{Ps9} - m_{Pc9})$	$2(\ell_{Ps11} + m_{Pc11})$	$2(\ell_{Ps13} - m_{Pc13})$	
M_{PC}	L_{Ps3}	$-L_{Ps5}$	L_{Ps7}	$-L_{Ps9}$	L_{Ps11}	$-L_{Ps13}$	
M_{PS}	$-L_{Pc3}$	L_{Pc5}	$-L_{Pc7}$	L_{Pc9}	$-L_{Pc11}$	L_{Pc13}	
a_{xc}	a_{xc3}	a_{xc5}	a_{xc7}	a_{xc9}	a_{xc11}	a_{xc13}	
a_{xs}	a_{xs3}	a_{xs5}	a_{xs7}	a_{xs9}	a_{xs11}	a_{xs13}	
a_{yc}	a_{yc3}	a_{yc5}	a_{yc7}	a_{yc9}	a_{yc11}	a_{yc13}	
a_{ys}	a_{ys3}	a_{ys5}	a_{ys7}	a_{ys9}	a_{ys11}	a_{ys13}	

TABLE A-2 FORCES AND MOMENTS IN FIXED FRAME FOR A 4 BLADED ROTOR SYSTEM

EQUATIONS AND OUTPUT FORMAT FOR VERTICAL COMPONENTS

HARMONIC NO. → FORCE ↓	2	3	4	5	8	12
T_c	T_{c2}	T_{c3}	T_{c4}	T_{c5}	T_{c8}	T_{c12}
T_s	T_{s2}	T_{s3}	T_{s4}	T_{s5}	T_{s8}	T_{s12}
Q_c	Q_{c2}	Q_{c3}	Q_{c4}	Q_{c5}	Q_{c8}	Q_{c12}
Q_s	Q_{s2}	Q_{s3}	Q_{s4}	Q_{s5}	Q_{s8}	Q_{s12}
T_{P_c}	$4T_{P_{c2}}$	$4T_{P_{c3}}$	$4T_{P_{c4}}$	$4T_{P_{c5}}$	$4T_{P_{c8}}$	$4T_{P_{c12}}$
T_{P_s}	$4T_{P_{s2}}$	$4T_{P_{s3}}$	$4T_{P_{s4}}$	$4T_{P_{s5}}$	$4T_{P_{s8}}$	$4T_{P_{s12}}$
Q_{P_c}	$4Q_{P_{c2}}$	$4Q_{P_{c3}}$	$4Q_{P_{c4}}$	$4Q_{P_{c5}}$	$4Q_{P_{c8}}$	$4Q_{P_{c12}}$
Q_{P_s}	$4Q_{P_{s2}}$	$4Q_{P_{s3}}$	$4Q_{P_{s4}}$	$4Q_{P_{s5}}$	$4Q_{P_{s8}}$	$4Q_{P_{s12}}$
a_{T_c}	$a_{T_{c2}}$	$a_{T_{c3}}$	$a_{T_{c4}}$	$a_{T_{c5}}$	$a_{T_{c8}}$	$a_{T_{c12}}$
a_{T_s}	$a_{T_{s2}}$	$a_{T_{s3}}$	$a_{T_{s4}}$	$a_{T_{s5}}$	$a_{T_{s8}}$	$a_{T_{s12}}$

<u>DEFINITION OF SUBSCRIPTS</u>

SUBSCRIPT→	C2	C3	C4	C5	C7	C8	C9	C11	C12	C12
i →	3	4	5	6	8	9	10	12	13	14

SUBSCRIPT→	S2	S3	S4	S5	S7	S8	S9	S11	S12	S13
i →	17	18	19	20	22	23	24	26	27	28

APPENDIX B - NASA AMES HUB LOADS TABULATED TEST RESULTS

The data reduction method and output format for the hub balance loads was described in Appendix A. Enclosed herein are the computer output tabulations for this data reduction. Listed below are equations to provide the total vibratory load, sine and cosine components, for the following:

4/REV LONGITUDINAL FORCE

$$F_{x4} = X + XP + AX$$

4/REV LATERAL FORCE

$$F_{y4} = Y + YP + AY$$

4/REV VERTICAL FORCE

$$F_{z4} = T + TP + AT$$

4/REV PITCHING MOMENT

$$M_{y4} = M + MP$$

4/REV ROLLING MOMENT

$$M_{x4} = L + LP$$

4/REV TORQUE

$$Q_4 = Q + QP$$

2VR PHASE II 6 DYNAMIC DATA

TST-727 PH-1 TJ-12..2.01;3 ID-PRESSJUTO 13 FEB 75005;33 PAGE 2

RUN;SEQ 1003
2.01;3

		3	5	7	9	11	13
1	XC	-2.7382	-26.637	0.1606	-2.8929	-8.5715	8.4538
2	XS	-11.490	3.2575	0.3384	-14.949	-7.4555	-11.049
3	YC	-11.490	-8.2575	0.3384	14.949	-7.4555	11.049
4	YS	2.7382	-26.637	-0.1606	-2.8929	8.5715	8.4538
5	LC	4.3697	-0.8157	-1.6226	-1.8049	1.0087	3.0214
6	LS	-3.2149	-0.8972	1.9769	-0.4106	1.2002	1.5488
7	MC	-3.2149	0.8972	1.9789	0.4106	1.2402	-1.5488
8	MS	-4.3697	-0.8157	1.6226	-1.8049	-1.0087	3.0214
9	XPC	-2.5698	0.3561	0.5383	0.3779	0.1239	0.0719
10	XPS	0.9193	0.1774	-0.3556	-0.1623	0.0114	0.0420
11	YPC	0.9193	-0.1774	-0.3556	0.1623	0.0114	-0.0420
12	YPS	2.5698	0.3061	-0.5383	0.3779	-0.1236	0.0719
13	LPC	0.7793	8.0534	0.5550	-1.4428	-0.2864	0.0508
14	LPS	-13.223	-2.0611	3.0799	-1.3790	0.5311	-0.4009
15	MPC	-13.223	2.0011	3.0799	1.3790	0.5311	0.4009
16	MPS	-3.7793	0.0564	-0.5550	-1.4428	0.2864	0.0508
17	AXC	-0.0922	-0.1046	0.1527	0.0072	-0.0067	0.0043
18	AXS	-0.1112	-0.0331	0.0398	-0.1815	-0.0689	0.0128
19	AYC	-0.1112	0.0331	0.0398	0.1815	-0.0689	-0.0128
20	AYS	0.0922	-0.1645	-0.1527	0.0072	0.0067	0.0043

		2	3	4	5	8	12
1	TC	63.531	-19.417	2.3947	-15.108	-26.216	7.1277
2	TS	48.925	59.177	-16.487	5.1224	-23.460	-4.7057
3	QC	0.9575	1.6046	-0.2044	0.2850	-1.8646	-0.0469
4	QS	-3.7891	1.4917	1.1077	1.7064	1.0372	0.1967
5	TPC	-2.7913	37.882	-26.717	-6.1807	1.9935	-2.1267
6	TPS	15.684	22.596	-16.615	2.4407	-3.5868	0.0000
7	QPC	-0.0812	1.1027	-0.7777	-0.1799	0.0580	-0.0619
8	QPS	0.4565	0.6577	-0.4836	0.0671	-0.1045	0.0000
9	ATC	0.5808	-0.4076	0.0232	-0.1184	-0.2440	0.0635
10	ATS	0.5125	0.5491	-0.1794	0.0037	-0.2660	-0.0458

ORIGINAL PAGE IS OF POOR QUALITY

PRELIMINARY DATA

TST-727 PH-1 TN-12..2.01:5 ID-PRESSOUTO 13 FEB 75@05:33 PAGE 3

RUN:SEQ 1005

2.0T:5

		3	5	7	9	11	13
1	XC	-20.146	8.4998	14.828	-9.2705	-8.8737	-6.1432
2	XS	7.2142	29.160	14.342	3.2511	0.5106	-6.0367
3	YC	7.2142	-29.160	14.342	-3.2511	0.5106	6.0367
4	YS	20.146	8.4998	-14.828	-9.2705	8.8737	-6.1432
5	LC	0.1276	0.0628	1.5520	0.1213	0.1671	0.7235
6	LS	-1.9597	-0.9078	0.5482	-1.2189	3.0771	0.1353
7	TC	-1.9597	0.9078	0.5482	1.2189	3.0771	-0.1353
8	TS	-0.1276	0.0628	-1.5520	0.1213	-0.1671	0.7235
9	XPC	-0.7823	-1.1701	-0.0319	-0.0066	0.1199	0.0290
10	XPS	1.7054	0.6235	-0.4526	-0.0532	-0.0291	0.1839
11	YPC	1.7054	-0.6235	-0.4526	0.0532	-0.0291	-0.1839
12	YPS	0.7823	-1.1701	0.0319	-0.0066	-0.1199	0.0290
13	LPC	-6.1288	5.0083	2.0420	-0.2252	-0.0981	0.7661
14	LPS	-5.7346	4.0403	0.7179	0.1304	0.5907	-0.4792
15	TPC	-5.7346	-4.0403	0.7179	-0.1304	0.5907	0.4792
16	TPS	6.1288	5.0083	-2.0420	-0.2252	0.0981	0.7661
17	AXC	-0.1337	0.0625	0.1017	-0.0338	0.0264	-0.0640
18	AXS	0.0425	0.2565	0.0480	0.0281	0.0050	-0.0171
19	AYC	0.0425	-0.2565	0.0480	-0.0281	0.0050	0.0171
20	AYS	0.1337	0.0625	-0.1017	-0.0338	-0.0264	-0.0640

	2	3	4	5	6	12
TC	27.011	20.814	20.965	-28.756	-3.4048	4.9277
TS	-49.325	16.371	2.8375	35.471	-5.5945	11.201
UC	2.4121	-0.6149	-0.0154	2.7732	-4.1677	0.7269
US	5.3778	-4.0958	3.1917	-2.9419	-1.0607	-4.0212
TPC	6.6598	29.309	-19.539	4.2534	-0.0665	-1.3232
TPS	-0.3988	-7.7758	-2.5255	-21.001	3.1236	-1.3242
UPC	0.2515	0.8531	-0.5687	0.1244	-0.0019	-0.0387
UPS	-0.0116	-0.2263	-0.0735	-0.6113	0.0509	-0.0387
ATC	0.5076	0.1660	0.1818	-0.2343	-0.0317	0.0706
ATS	-0.2514	0.2270	-0.0744	0.3465	-0.1635	0.0854

PRELIMINARY DATA

ORIGINAL PAGE IS OF POOR QUALITY

RUNSEQ 1006
2.01:6

		3	5	7	9	11	13
1	XC	-44.210	15.[illegible]67	-0.8245	-2[illegible].577	-3.6555	4.2336
2	XS	-7.7243	32.403	-44.229	-1.2971	-5.6[illegible]98	9.6[illegible]3
3	YC	-7.7243	-32.[illegible]3	-43.[illegible]29	1.2971	-5.6[illegible]98	-9.6[illegible]3
4	YS	44.210	15.[illegible]67	0.8248	-20.577	3.6555	4.2390
5	LC	1.[illegible]2[illegible]	-0.32[illegible]	-2.4034	-0.2[illegible]	1.3[illegible]45	-0.8472
6	LS	-1.4919	1.7511	1.4830	-1.5042	-0.7595	2.0863
7	[illegible]C	-1.4919	-1.7511	1.4838	1.5042	-0.7595	-2.0863
8	[illegible]S	-1.8820	-0.3244	2.4603	-0.2[illegible]	-1.3545	-0.8472
9	XPC	0.4094	-0.5[illegible]54	-0.1452	-0.07[illegible]	-0.0466	0.0915
10	XPS	1.0356	0.37[illegible]	-0.4760	0.1154	0.2440	0.0205
11	YPC	1.[illegible]	-0.3760	-0.4760	-0.1154	0.2440	-0.0205
12	YPS	-0.[illegible]4	-0.5[illegible]54	0.1452	-0.0754	0.0466	0.0915
13	LPC	-5.[illegible]27	2.7310	2.4052	0.5[illegible]	-1.0012	-0.0824
14	LPS	-0.1[illegible]2	1.[illegible]	0.2577	0.1172	-0.6720	-0.4476
15	NPC	-0.14[illegible]	-1.[illegible]	0.2577	-0.1172	-0.6720	0.4476
16	NPS	5.4027	2.7918	-2.4[illegible]52	0.55[illegible]	1.0012	-0.0824
17	AXC	-0.3454	0.1386	0.0169	-0.1706	-0.0219	0.0257
18	AXS	-0.1534	0.3131	-0.3776	-0.0183	-0.0943	0.0596
19	AYC	-0.1534	-0.3131	-0.3776	0.0183	-0.0943	-0.0596
20	AYS	0.3454	0.1385	-0.0169	-0.1706	0.0219	0.0257

	2	3	4	5	6	12
TC	-4.7785	39.521	-25.[illegible]33	-0.7756	25.[illegible]93	-8.[illegible]
TS	24.531	22.5[illegible]1	-25.448	42.[illegible]43	-2.26[illegible]	11.4[illegible]
QC	-1[illegible].889	0.9830	-0.6068	1.7231	1.3753	0.4214
QS	0.1286	-0.9575	-0.4675	1.3217	-1.6074	0.[illegible]21
TPC	-11.[illegible]47	8.7062	-6.4404	1.3292	4.5[illegible]57	0.[illegible]
TPS	17.545	-15.751	-8.3075	-11.165	-1.9273	-0.[illegible]
QPC	-0.3405	0.2534	-0.2457	0.0367	0.1335	0.0271
QPS	0.51[illegible]7	-0.4585	-0.2418	-0.3250	-0.0561	-0.[illegible]77
ATC	0.3319	0.4551	-0.0744	0.0512	0.2135	-0.1171
ATS	0.5759	0.2160	-0.2453	0.4905	-0.0665	0.1171

PRELIMINARY DATA

RUN:SEQ 1007
2.01:7

		3	5	7	9	11	13
1	XC	-2[illegible].997	-42.141	-21.784	1.3018	16.549	-9.3773
2	XS	-3[illegible].502	[illegible].5374	12.542	-33.422	-4.7457	-11.[illegible]04
3	YC	-3[illegible].502	-0.5374	12.542	33.422	-4.7457	11.[illegible]04
4	YS	2[illegible].997	-42.141	21.7[illegible]	1.3018	-1[illegible].539	-9.3773
5	LC	-[illegible].5575	-0.551[illegible]	2.5[illegible]2	[illegible].7069	0.0317	-0.[illegible]5[illegible]4
6	LS	-2.[illegible]	1.45[illegible]	-[illegible].[illegible]31[illegible]	-[illegible].2[illegible]5	-0.0277	-[illegible].[illegible]89
7	[illegible]C	-2.[illegible]2	-1.45[illegible]	-0.441[illegible]	[illegible].2906	-0.0277	0.[illegible]989
8	[illegible]S	[illegible].5575	-[illegible].551[illegible]	-2.5[illegible]2	[illegible].7[illegible]	-0.[illegible]317	-[illegible].[illegible]5[illegible]4
9	XPC	-[illegible].4777	[illegible]	-[illegible].251[illegible]	-[illegible].[illegible]473	0.[illegible]45	0.0701
10	XPS	2.137[illegible]	-[illegible].2[illegible]71	-[illegible].4[illegible]	[illegible].1[illegible]2	[illegible].1[illegible]	0.1[illegible]20
11	YPC	2.1376	[illegible].2[illegible]7[illegible]	-[illegible].4[illegible]	-[illegible].1[illegible]2	[illegible].1[illegible]	-[illegible].1[illegible]20
12	YPS	[illegible].4777	[illegible]	[illegible].251[illegible]	-[illegible].[illegible]473	-0.[illegible]4[illegible]	[illegible].0701
13	LPC	-[illegible]	-1.4[illegible]	2.5755	[illegible].9[illegible]6	-0.[illegible]287	[illegible].679[illegible]
14	LPS	-[illegible].1[illegible]	[illegible].2[illegible]43	-[illegible].2[illegible]05	-[illegible].14[illegible]	0.[illegible]31	-0.[illegible]
15	[illegible]PC	-[illegible].1[illegible]	-0.2[illegible]43	-[illegible].2[illegible]5	[illegible].14[illegible]	0.[illegible]31	[illegible].6[illegible]1
16	[illegible]PS	[illegible]	-1.45[illegible]	-2.[illegible]755	[illegible]	[illegible].[illegible]287	[illegible].[illegible]7[illegible]
17	AXC	-[illegible].1[illegible]1	-[illegible].2793	-[illegible].1[illegible]57	-[illegible]	0.1[illegible]2	-[illegible].[illegible]756
18	AXS	-[illegible].3773	-[illegible].[illegible]25	0.11[illegible]	-[illegible].2725	-0.0[illegible]	-0.1[illegible]76
19	AYC	-[illegible].3773	0.0025	0.1149	[illegible].2725	-0.016[illegible]	[illegible].[illegible]76
20	AYS	[illegible].1[illegible]1	-[illegible].2793	0.1[illegible]67	-[illegible].[illegible]48	-0.1182	-0.0756

	2	3	4	5	8	12
TC	3.3641	2[illegible].002	2.0347	-2[illegible].54[illegible]	2[illegible].925	-16.217
TS	1[illegible].3[illegible]	-5.7156	-64.3[illegible]7	24.2[illegible]	-12.1[illegible]	1[illegible]
CC	-2.[illegible]03	1.4[illegible]6	-2.532[illegible]	[illegible]	-[illegible]	-[illegible].1[illegible]
CS	3.0442	-1.0554	-3.0997	-[illegible].15[illegible]	1.174[illegible]	[illegible].3[illegible]1
TPC	7.7758	31.566	[illegible]	2.[illegible]7	2.525[illegible]	[illegible]
TPS	43.39[illegible]	-16.017	-17.2[illegible]	3.[illegible]211	7.177[illegible]	-0.[illegible]
OPC	0.2263	[illegible].[illegible]139	0.247[illegible]	0.[illegible]71	[illegible].[illegible]735	[illegible].[illegible]174
OPS	1.2632	-[illegible].4[illegible]02	-[illegible].5[illegible]	[illegible].1141	[illegible].2[illegible]	-[illegible]
ATC	0.1523	[illegible].1647	[illegible].1555	-[illegible].25[illegible]	[illegible].[illegible]675	-[illegible].17[illegible]
ATS	0.4942	-0.1206	-[illegible].4002	0.1745	-[illegible].[illegible]57[illegible]	[illegible].[illegible]59

PRELIMINARY DATA

TST-727 PH-1 IN-12..2.01:9 — ID-PRESSDUTO — 13 FEB 75#05:33 — PAGE 6

RUN:SEQ 1007
2.01:9

	3	5	7	9	11	13
XC	-12.619	-71.443	14.[illegible]	[illegible]	19.440	7.7564
XS	-14.53[illegible]	29.596	[illegible]	-15.728	-4.9719	5.5259
YC	-14.53[illegible]	-29.596	14.[illegible]	15.728	-4.9719	-5.5259
YS	12.619	-71.443	-14.[illegible]	[illegible]	-19.[illegible]30	7.7564
LC	[illegible]	2.9713	[illegible]	[illegible].4171	0.[illegible]40	0.3527
LS	-2.4574	-2.4[illegible]	0.0757	-0.7248	0.1324	[illegible].2653
[illegible]C	-2.4574	2.[illegible]	0.[illegible]757	0.7248	0.1324	0.2[illegible]3
[illegible]S	[illegible]	2.9713	[illegible]	0.4171	[illegible]	0.3527
XFC	-2.14[illegible]	[illegible]	0.54[illegible]2	0.1130	-0.1057	0.0392
XFS	[illegible].7675	-1.[illegible]	[illegible]	-[illegible].5733	[illegible]	0.26[illegible]
YFC	0.[illegible]675	1.[illegible]	[illegible]	[illegible].5733	-0.[illegible]	-[illegible].2[illegible]
YFS	2.1453	-0.[illegible]	-0.5[illegible]	0.1130	0.1057	0.0392
LFC	0.6517	-6.[illegible]	-1.[illegible]523	-2.7762	0.4740	1.[illegible]04
LFS	-11.[illegible]	7.2[illegible]47	2.[illegible]	[illegible]22	-0.34[illegible]	-0.67[illegible]
[illegible]C	-11.[illegible]	-7.2[illegible]47	2.3[illegible]	-[illegible]22	-0.3[illegible]	0.[illegible]706
[illegible]S	-0.6517	-6.[illegible]	1.[illegible]523	-2.7762	-0.4[illegible]	1.0904
[illegible]C	[illegible]	[illegible]	0.12[illegible]	[illegible].3221	0.1712	0.0587
XAYS	-0.111[illegible]	0.2732	[illegible].1245	[illegible].1251	-0.0497	0.0518
AYC	-0.111[illegible]	-0.2732	0.1295	0.1201	-0.0497	-0.0518
AYS	-0.0559	-0.5590	-0.1270	-0.3221	-0.1712	0.0587

	2	3	4	5	8	12
TC	28.9[illegible]1	-7.5210	27.610	-127.45	[illegible]12	-13.5[illegible]
TS	[illegible].570	26.579	[illegible].170	-1[illegible].724	5.2[illegible]	2[illegible].277
UC	-0.3922	-0.1601	-[illegible]624	-1.[illegible]99	-0.3192	-[illegible]
US	3.4316	0.8776	-1.6219	-0.[illegible]1	1.3[illegible]57	0.351[illegible]
TPC	-29.5[illegible]	31.635	-[illegible]1.134	32.1[illegible]	-2.[illegible]07	0.53[illegible]
TPS	62.20[illegible]	18.[illegible]	-2[illegible].312	9.1[illegible]5	1.12[illegible]	-0.3[illegible]
CPC	-0.[illegible]	0.920[illegible]	-[illegible]152	[illegible]344	-[illegible]71	0.[illegible]27[illegible]
UPS	1.[illegible]107	0.5494	-[illegible]241	0.2[illegible]	[illegible].0329	-0.[illegible]11[illegible]
[illegible]C	0.5271	-0.0940	0.3355	-1.2556	[illegible].1594	-0.1475
ATS	0.6658	0.1550	0.2[illegible]62	-0.13[illegible]	[illegible].0354	0.2623

PRELIMINARY DATA

C. 2

TST-727 PH-1 TN-12..2.01:10 ID-PRESSUUTO 13 FEB 75W05:33 PAGE 7

RUN:SEQ 1010
2.01:10

		3	5	7	9	11	13
1	XC	-41.249	-91.361	11.399	-22.314	33.276	2.9550
2	XS	-40.047	-20.503	-19.636	-5.9643	-21.851	-3.0268
3	YC	-40.047	20.503	-19.636	5.9643	-21.551	3.0268
4	YS	41.249	-91.351	-11.399	-22.314	-33.276	2.9550
5	LC	2.0044	0.1390	-0.0271	-0.0775	-0.4155	0.1231
6	LS	-0.6741	2.7948	-0.8618	0.3355	0.0346	0.0140
7	[illegible]C	-0.6741	-2.7948	-0.8518	-0.3355	0.0346	-0.0140
8	[illegible]S	-2.0044	0.1390	0.0271	-0.0775	0.4155	0.1231
9	XPC	-0.9363	0.8330	0.7767	0.0541	0.0165	0.0609
10	XPS	1.5625	-0.3939	-0.9745	-0.0766	-0.0717	0.1305
11	YPC	1.5625	0.3979	-0.9745	0.0765	-0.0717	-0.1305
12	YPS	0.9363	0.8330	-0.7767	0.0541	-0.0165	0.0609
13	LPC	-5.1979	-3.3645	2.8757	-0.4449	0.2989	0.4289
14	LPS	-7.1507	-2.9617	5.3207	-0.0961	0.2098	-0.6094
15	[illegible]PC	-7.1507	2.9617	5.3207	0.0961	0.2095	0.6094
16	[illegible]PS	5.1979	-3.3645	-2.8757	-0.4449	-0.2989	0.4289
17	AXC	-0.2367	-0.6995	0.1294	-0.1049	0.2725	0.0416
18	AXS	-0.3523	-0.1944	-0.1879	-0.0729	-0.2073	-0.0301
19	AYC	-0.3523	0.1944	-0.1879	0.0729	-0.2073	0.0301
20	AYS	0.2367	-0.6995	-0.1294	-0.1849	-0.2725	0.0416

	2	3	4	5	8	12
TC	-0.3073	22.656	42.360	-22.958	-2.9987	2.8955
TS	41.317	26.917	19.881	-47.396	15.013	8.2051
QC	-6.0741	0.7605	1.7451	0.4262	0.4391	0.0562
QS	2.4594	1.7890	0.3081	1.3221	0.7613	0.2583
TPC	-24.191	29.109	12.960	-3.5886	-7.1776	0.2656
TPS	73.238	-4.3863	0.1994	14.486	7.1776	2.6564
QPC	-0.7042	0.8473	0.3772	-0.1045	-0.2089	0.0077
QPS	2.1318	-0.1277	0.0058	0.4217	0.2089	0.0774
ATC	0.1208	0.1501	0.4283	-0.2221	0.0232	0.0354
ATS	0.7919	0.3282	0.1403	-0.5198	0.1354	0.0666

PRELIMINARY DATA

ORIGINAL PAGE IS OF POOR QUALITY

TST-727 PH-1 TN-12..2.01:11 ID-PRESSUUTO 13 FEB 75005:33 PAGE 8

RUN:SEQ 1011
2.01:11

		3	5	7	9	11	13
1	XC	-19.592	34.268	29.225	34.509	-8.7037	-6.3755
2	XS	0.0605	5.9403	-21.549	13.124	-3.0713	3.5654
3	YC	0.0605	-5.9403	-21.549	-13.124	-3.0713	-3.5654
4	YS	19.592	34.268	-29.225	34.509	8.7037	-6.3755
5	LC	0.5544	-3.0606	-2.1307	-0.7547	-0.1250	-0.1239
6	LS	3.5980	-1.5917	1.5436	-0.4179	0.3032	0.2981
7	MC	3.5980	1.5917	1.5436	0.4179	0.3032	-0.2981
8	MS	-0.5544	-3.0606	2.1307	-0.7547	0.1250	-0.1239
9	XPC	0.1473	0.0440	-0.4187	-0.2942	-0.0193	0.0365
10	XPS	1.6509	0.1503	-0.7075	0.5676	0.0428	0.1671
11	YPC	1.6509	-0.1503	-0.7075	-0.5676	0.0428	-0.1671
12	YPS	-0.1473	0.0440	0.4187	-0.2942	0.0193	0.0365
13	LPC	-7.6524	0.5576	3.9553	3.0939	-0.1243	0.6769
14	LPS	-2.4402	-0.4619	-0.5249	0.2349	-0.1572	-0.4406
15	MPC	-2.4402	0.4619	-0.5249	-0.2349	-0.1572	0.4406
16	MPS	7.6524	0.5675	-3.9553	3.0939	0.1543	0.6769
17	AXC	-0.2402	0.3426	0.2102	0.3221	-0.0782	-0.0416
18	AXS	-0.1207	0.0965	-0.2105	0.1263	-0.0255	0.0354
19	AYC	-0.1207	-0.0965	-0.2105	-0.1263	-0.0255	-0.0354
20	AYS	0.2402	0.3426	-0.2102	0.3221	0.0782	-0.0416

	2	3	4	5	6	12
TC	64.949	1.2649	-29.721	67.272	-54.112	8.6155
TS	12.887	12.728	-33.987	82.056	33.164	23.353
QC	-2.7909	-0.7563	2.1381	1.1529	0.4582	0.2264
QS	-7.0507	-0.1043	-0.0316	-1.4966	-0.3033	0.2606
TPC	-11.298	19.074	4.7186	-2.3261	-0.0665	-3.2565
TPS	60.080	-13.808	10.700	-0.9959	-5.7820	-1.2627
QPC	-0.3289	0.5552	0.1374	-0.0677	-0.0019	-0.0944
QPS	1.7458	-0.5475	0.3115	-0.0294	-0.1563	-0.1366
ATC	0.5967	0.0720	-0.3051	0.7334	-0.5037	0.0915
ATS	0.4942	0.1769	-0.5149	0.8163	0.2538	0.2111

PRELIMINARY DATA

TST-727 PH-1 TN-12..2.01:14 ID-PRESSUTO 13 FEB 75 05:33 PAGE 9

RUN:SEQ 1014
2.01:14

		3	5	7	9	11	13
1	XC	-15.523	10.190	-10.653	0.3163	40.552	-1.7259
2	XS	19.739	12.086	18.879	-10.086	-5.2553	2.0146
3	YC	19.739	-12.086	18.879	10.086	-5.2553	-2.0146
4	YS	15.523	10.190	10.653	0.3163	-40.552	-1.7259
5	LC	0.2529	0.9498	-0.4981	-0.4255	-0.9185	0.8879
6	LS	-2.0913	-2.6319	0.8607	0.7925	0.3760	0.2876
7	MC	-2.0913	2.6319	0.8607	-0.7925	0.3760	-0.2876
8	MS	-0.2523	0.9498	0.4981	-0.4255	0.9185	0.8879
9	XPC	0.2876	-0.6048	0.3552	-0.0169	0.1338	-0.2016
10	XPS	1.1674	0.4559	0.3514	0.1152	0.2102	0.0916
11	YPC	1.1674	-0.4559	0.3514	-0.1152	0.2102	-0.0916
12	YPS	-0.2876	-0.6048	-0.3552	-0.0169	-0.1338	-0.2016
13	LPC	-5.5528	3.1554	-2.2443	0.5467	-1.2879	0.7922
14	LPS	-0.9635	1.8342	0.9182	-0.1434	0.4215	0.7263
15	MPC	-0.9635	-1.8342	0.9182	0.1434	0.4215	-0.7263
16	MPS	5.5528	3.1554	2.2443	0.5467	1.2879	0.7922
17	ΔXC	-0.1674	0.0946	-0.1063	0.0190	0.3798	-0.0326
18	ΔXS	0.0927	0.1465	0.1380	-0.0726	-0.0181	0.0584
19	ΔYC	0.0927	-0.1465	0.1380	0.0726	-0.0181	-0.0584
20	ΔYS	0.1674	0.0946	0.1063	0.0190	-0.3798	-0.0326

	2	3	4	5	8	12
TC	-84.496	38.101	-27.994	21.663	-11.947	-17.213
TS	30.110	43.686	58.702	24.827	-36.172	3.2310
QC	0.2961	-4.3062	-0.3948	-0.3774	0.2644	0.1616
QS	0.6494	0.1382	-0.4456	1.7782	1.5670	0.4436
TPC	-3.8547	11.830	-3.8391	0.5317	5.7820	-0.1994
TPS	-60.852	-15.817	-7.1112	-12.229	-11.763	-3.9211
QPC	-0.1122	0.3443	-0.2573	0.0155	0.1583	[illegible]
QPS	-2.0042	-0.4604	-0.2070	-0.3560	-0.3424	-0.1141
ATC	-0.7504	0.5027	-0.0927	0.2036	-0.0451	-0.1835
ATS	0.4381	0.4198	0.2831	0.2245	-0.2745	-0.0293

PRELIMINARY DATA

RUN:SEQ 1065
2.01:15

		3	5	7	9	11	13
1	XC	-22.379	-74.414	197.36	114.13	-74.514	16.310
2	XS	6.6072	-38.874	64.688	13.380	-56.628	-39.771
3	YC	6.6072	38.874	64.688	-13.380	-56.628	39.771
4	YS	22.379	-74.414	-197.36	114.13	74.514	16.310
5	LC	0.9372	1.3390	-5.3049	0.1352	0.1455	0.2385
6	LS	1.3326	3.6133	-0.5956	0.4656	-0.1544	-0.7741
7	MC	1.3326	-3.6133	-0.5956	-0.4656	-0.1544	0.7741
8	MS	-0.9372	1.3390	5.3049	0.1352	-0.1455	0.2335
9	XPC	-0.3342	-0.4443	0.9632	-1.2938	-1.3164	-0.6677
10	XPS	1.5045	-0.9075	1.5081	-0.5803	0.2845	0.0175
11	YPC	1.5045	0.9075	1.5081	0.5803	0.2845	-0.0175
12	YPS	0.3342	-0.4443	-0.9632	-1.2938	1.3164	-0.6677
13	LPC	-6.0833	-3.2080	-6.5653	-0.1324	1.2315	1.3473
14	LPS	-4.3521	3.7088	1.4343	6.8804	-6.4193	2.9486
15	MPC	-4.3521	-3.7088	1.4343	-6.8804	-6.4193	-2.9486
16	MPS	6.0833	-3.2080	8.5653	-0.1324	-1.2315	1.3473
17	AXC	-0.1760	-0.6095	1.6114	1.0233	-0.6265	0.1245
18	AXS	-0.0500	-0.4566	0.4640	0.1364	-0.4819	-0.3441
19	AYC	-0.0500	0.4566	0.4640	-0.1364	-0.4819	0.3441
20	AYS	0.1760	-0.6095	-1.6114	1.0233	0.6265	0.1245

	2	3	4	5	6	12
TC	-55.632	81.148	46.624	130.80	-47.378	-18.722
TS	-35.427	54.203	0.4587	-44.049	-42.506	-11.480
QC	2.2956	-0.7094	-0.0382	1.6581	2.0912	-0.1721
QS	-0.6723	-0.5675	-2.7600	-0.6647	1.5645	0.1183
TPC	-225.43	22.196	-166.66	15.604	-0.2304	-11.963
TPS	173.99	-11.298	-75.498	3.7862	23.261	5.0509
QPC	-6.5619	0.6461	-4.8518	0.4624	-0.0271	-0.3482
QPS	5.0646	-0.3289	-2.1976	0.1103	0.6771	0.1470
ATC	-0.5674	0.7504	0.1159	0.9042	0.0679	0.0024
ATS	0.5918	0.4600	0.2819	-0.7944	-0.2001	0.2245

PRELIMINARY DATA

TST-727 PH-1 TN-12..2.01:16 ID-PRESSUUTO 13 FEB 75.05:33 PAGE 11

RUN:SEJ 1016
2.01:16

		3	5	7	9	11	13
1	XC	-25.168	17.993	60.047	-67.569	25.259	83.422
2	XS	60.821	-206.86	211.20	110.54	46.732	7.2929
3	YC	60.821	206.86	211.20	-110.54	46.732	-7.2929
4	YS	25.166	17.993	-60.047	-67.569	-25.259	83.422
5	LC	-2.7657	-4.4697	-2.5168	-0.6515	1.2373	0.4316
6	LS	-1.5381	3.5637	-0.7115	-0.1017	0.2262	-1.4255
7	MC	-1.5381	-3.5637	-0.7115	0.1017	0.2262	1.4255
8	MS	2.7657	-4.4697	2.5168	-0.6515	-1.2373	0.4316
9	XPC	-0.4671	6.7264	-1.7333	2.0578	-3.6716	1.2473
10	XPS	-5.5444	1.9656	-2.6492	0.1689	-1.6037	-0.8790
11	YPC	-5.5444	-1.9656	-2.6492	-0.1689	-1.6037	0.8790
12	YPS	0.4671	6.7264	1.7333	2.0578	3.6716	1.2473
13	LPC	25.685	-3.9175	15.125	-3.1569	14.140	-6.2959
14	LPS	8.3627	-33.811	-2.7048	-9.5105	-13.348	-3.6994
15	MPC	8.3627	33.811	-2.7048	9.5105	-13.348	3.6994
16	MPS	-25.685	-3.9175	-15.125	-3.1569	-14.140	-6.2959
17	AXC	-0.1249	0.2566	0.4710	-0.6749	0.1557	0.6986
18	AXS	0.3572	-1.8085	1.6688	0.9139	0.4288	0.0133
19	AYC	0.3572	1.8085	1.6688	-0.9139	0.4288	-0.0133
20	AYS	0.1249	0.2566	-0.4710	-0.6749	-0.1557	0.6986

	2	3	4	5	8	12
TC	-17.832	49.645	-33.093	47.581	-23.603	22.122
TS	-143.62	51.631	-31.361	69.613	-176.49	-11.3[illegible]
WC	4.5456	0.3873	3.0185	1.9773	0.7901	0.2506
WS	-2.5117	0.6159	1.8429	3.0294	-0.3226	1.43[illegible]
TPC	-259.66	-64.134	-76.694	-93.907	1.0634	-1.86[illegible]
TPS	298.74	63.070	-177.91	63.469	-55.294	-54.947
WPC	-7.5582	-1.8668	-2.2382	-2.7335	0.0310	-0.0542
WPS	8.6957	1.8359	-5.1787	1.8475	-1.6095	-1.7449
ATC	-0.1354	0.6760	-0.6162	0.4722	-0.3941	0.16[illegible]
ATS	0.0232	0.7321	-0.4551	-0.0598	-0.4869	0.40[illegible]

PRELIMINARY DATA

TST-727 PH-1 TN-12..2.01:20 IU-PRESSOUTO 13 FEB 75@05:33 PAGE 12

RUN:SEQ *1020*
2.01:20

		3	5	7	9	11	13
1	XC	-8.9577	-5.5421	-27.095	-46.595	-44.203	-16.055
2	XS	29.672	8.1017	-21.458	48.847	19.570	-11.796
3	YC	29.672	-8.1017	-21.458	-48.847	19.570	11.796
4	YS	8.9577	-5.5421	27.095	-46.595	44.203	-16.055
5	LC	0.5928	-1.3587	0.7440	1.2697	-0.0718	0.6923
6	LS	-1.4908	-0.5416	0.9098	0.3047	-0.1832	-0.0856
7	MC	-1.4908	0.5416	0.9098	-0.3047	-0.1832	0.0856
8	MS	-0.5928	-1.3587	-0.7440	1.2697	0.0718	0.6923
9	XPC	-1.8193	-0.0152	0.1559	-0.7458	0.1216	-0.1550
10	XPS	3.4353	1.0677	-0.2789	-0.4457	-0.0117	0.0318
11	YPC	3.4353	-1.0677	-0.2789	0.4457	-0.0117	-0.0318
12	YPS	1.8193	-0.0152	-0.1559	-0.7458	-0.1216	-0.1550
13	LPC	-11.883	4.7969	0.9300	-0.5729	-0.1788	0.4366
14	LPS	-14.654	-1.9616	1.2712	4.1778	0.5551	0.6316
15	MPC	-14.654	1.9616	1.2712	-4.1778	0.5551	-0.6316
16	MPS	11.883	4.7969	-0.9300	-0.5729	0.1788	0.4366
17	AXC	-0.0917	-0.0707	-0.2344	-0.4148	-0.3967	-0.1391
18	AXS	0.1938	0.0595	-0.2187	0.4227	0.2093	-0.0899
19	AYC	0.1938	-0.0595	-0.2187	-0.4227	0.2093	0.0899
20	AYS	0.0917	-0.0707	0.2344	-0.4148	0.3967	-0.1391

	2	3	4	5	8	12
TC	-79.573	43.916	-61.544	-3.2449	22.003	-3.6354
TS	34.780	64.019	14.862	10.814	-39.728	5.8605
QC	-4.2343	2.7801	3.5717	0.4711	0.3683	-0.0635
QS	-0.6430	-2.3906	0.5720	0.7025	1.0627	-0.1938
TPC	-47.120	61.542	-24.391	-13.159	-9.7031	-0.5981
TPS	80.350	-12.627	1.7944	-11.165	3.8547	1.2627
OPC	-1.3716	1.7914	-0.7100	-0.3830	-0.2824	-0.0174
OPS	2.3388	-0.3676	0.0522	-0.3250	0.1122	0.0368
ATC	-0.8298	0.5137	-0.1733	-0.0586	0.1428	0.0195
ATS	0.4295	0.7602	0.0512	0.0390	-0.1721	0.1196

PRELIMINARY DATA

IST-727 PH-1 TH-12..2.01:21 ID-PRESSOUTO 13 FEB 75@05:33 PAGE 13

RUN:SEQ 1021
2.01:21

		3	5	7	9	11	13
1	XC	-17.756	89.744	122.30	-7.1924	17.709	52.191
2	XS	28.452	-26.568	-239.89	75.193	72.716	-56.783
3	YC	28.452	26.563	-239.89	-75.193	72.716	56.783
4	YS	17.756	89.744	-122.30	-7.1924	-17.709	52.191
5	LC	-1.4841	-0.6989	-1.6205	-0.1937	1.4304	0.5278
6	LS	-0.8376	1.5275	1.4881	0.4022	-0.7517	0.0906
7	NC	-0.8376	-1.5275	1.4881	-0.4022	-0.7517	-0.0906
8	NS	1.4841	-0.6989	1.6205	-0.1937	-1.4304	0.5278
9	XPC	-2.1762	1.1810	2.0721	-0.6675	1.0020	-0.0551
10	XPS	5.1290	0.2948	-2.6300	-0.2279	0.6981	0.7542
11	YPC	5.1290	-0.2948	-2.6300	0.2279	0.6981	-0.7542
12	YPS	2.1762	1.1810	-2.0721	-0.6675	-1.0020	-0.0551
13	LPC	-18.706	-0.9281	7.8064	0.2511	-5.0220	3.4728
14	LPS	-19.406	-5.4344	14.252	3.4138	3.1478	-1.1875
15	NPC	-19.406	5.4344	14.252	-3.4138	3.1478	1.1875
16	NPS	18.706	-0.9281	-7.8064	0.2511	5.0220	3.4723
17	AXC	-0.1646	0.7692	1.0418	-0.0990	0.1107	0.4376
18	AXS	0.0819	-0.1810	-2.0250	0.6360	0.6669	-0.5280
19	AYC	0.0819	0.1810	-2.0250	-0.6360	0.6669	0.5280
20	AYS	0.1646	0.7692	-1.0418	-0.0990	-0.1107	0.4376

	2	3	4	5	8	12
TC	-97.511	129.74	12.476	-2.0030	5.5166	24.933
TS	-7.6730	99.455	-37.551	-83.926	-88.062	-24.417
QC	-6.0518	0.3774	0.1259	-1.1301	4.5666	1.4796
QS	-1.0941	0.0391	-3.6003	-0.4476	-0.2745	-1.1173
TPC	-170.93	86.331	-204.96	-15.817	6.0415	-0.3323
TPS	223.04	-25.587	-9.9689	11.697	29.043	[illegible]
QPC	-4.9756	2.5129	-5.9651	-0.4604	0.2341	[illegible]
QPS	6.4923	-0.7446	-0.2902	0.3405	[illegible]	[illegible]
ATC	-0.9322	1.1263	0.5857	0.4198	-0.2331	0.1554
ATS	0.6784	0.9359	0.4661	-0.6394	-0.7334	0.0163

PRELIMINARY DATA

ORIGINAL PAGE IS
OF POOR QUALITY

TST-727 PH-I TN-12..2.01:22 IO-PRESSOUTO 13 FEB 75.05:33 PAGE 14

RUN:SEJ 1022
2.01:22

		3	5	7	9	11	13
1	XC	-52.218	-34.615	305.19	17.661	22.537	59.240
2	XS	80.238	-25.483	383.89	11.885	-85.986	-56.846
3	YC	80.238	25.483	383.89	-11.885	-85.986	56.346
4	YS	52.218	-34.615	-305.19	17.661	-22.537	59.240
5	LC	-1.2554	-3.7404	-2.5351	-1.5572	1.1529	-0.1878
6	LS	-0.4440	-1.2469	-3.9698	0.0805	0.8526	-0.1748
7	MC	-0.4440	1.2469	-3.9698	-0.0805	0.8526	0.1748
8	MS	1.2554	-3.7401	2.5351	-1.5572	-1.1529	-0.1878
9	XPC	-6.3253	5.0053	-2.0052	0.5914	-2.1173	-0.8957
10	XFS	-0.7055	-1.0137	5.4065	1.5643	1.0086	-0.2849
11	YPC	-0.7055	1.0137	5.4065	-1.5643	1.0086	0.2849
12	YFS	6.3253	5.0053	2.0052	0.5914	2.1173	-0.8957
13	LPC	15.173	-14.040	-20.180	5.8617	-0.7475	0.4302
14	LPS	-20.906	-20.425	-19.588	-5.0141	-11.486	4.5413
15	MPC	-20.906	20.425	-19.588	5.0141	-11.486	-4.5413
16	MPS	-15.173	-14.040	20.180	5.8617	0.7476	0.4302
17	AXC	-0.4511	-0.2564	2.6630	0.1750	0.1172	0.5543
18	AXS	0.5970	-0.1575	3.1452	0.1473	-0.6741	-0.5633
19	AYC	0.5970	0.1575	3.1452	-0.1473	-0.6741	0.5633
20	AYS	0.4511	-0.2564	-2.6630	0.1750	-0.1172	0.5543

	2	3	4	5	8	12
TC	-62.659	151.52	11.499	114.45	-15.193	18.829
TS	-199.78	91.964	-77.253	130.67	-244.04	-63.111
QC	2.0122	-1.4393	0.4369	4.0246	1.3980	1.1593
QS	-4.6541	-7.1368	-0.1755	-4.2411	0.7009	-2.3[illegible]
TPC	-267.50	56.225	-182.83	-36.812	-29.641	0.1329
TPS	383.47	86.132	-73.039	72.840	14.486	-18.077
QPC	-6.3687	1.6366	-5.3219	-1.1298	-0.8528	0.0039
QPS	11.162	2.5071	-2.1260	2.1202	0.4217	-0.5262
ATC	-0.8039	1.6449	-0.1426	0.9445	-0.7724	0.1110
ATS	-0.4490	1.1397	-0.6138	0.9493	-1.6510	0.2345

PRELIMINARY DATA

TST-727 PH-1 TN-12..2.01:27 ID-PRESSOUTO 13 FEB 75-05:33 PAGE 15

RUN:SEQ 1027
2.01:27

	3	5	7	9	11	13
XC	-21.992	18.232	-2.1178	-35.029	14.156	1.5558
XS	-19.846	19.747	-2.7977	-46.876	-40.390	4.2394
YC	-19.846	-19.747	-2.7977	46.876	-40.390	-4.2394
YS	21.992	18.232	2.1178	-35.029	-14.156	1.5558
LC	3.0118	-0.0751	0.7710	0.1495	-0.6448	-0.5868
LS	-0.4661	-1.0692	-0.4103	1.2900	2.5449	0.3046
MC	-0.4661	1.0692	-0.4103	-1.2900	2.5449	-0.3046
MS	-3.0118	-0.0751	-0.7710	0.1495	0.6448	-0.5868
XPC	-2.5397	0.4037	0.3410	1.1977	1.2013	0.0467
XPS	-0.0417	1.5112	3.9050	0.4250	0.9477	0.1310
YPC	-0.0417	-1.5112	3.9050	-0.4250	0.9477	-0.1310
YPS	2.5397	0.4037	-0.3410	1.1977	-1.2013	0.0467
LPC	5.0135	5.9612	-18.087	-0.3786	-6.5153	0.4204
LPS	-11.292	-4.6750	-5.6996	-6.1562	3.5635	-0.6363
MPC	-11.292	4.6750	-5.6996	6.1562	3.5635	0.6363
MPS	-5.0135	5.9612	18.087	-0.3786	6.5153	0.4204
AXC	-0.1152	0.2036	0.0406	-0.2729	0.1212	0.0165
AXS	-0.2847	0.2190	0.0201	-0.3945	-0.3278	0.0079
AYC	-0.2847	-0.2190	0.0201	0.3945	-0.3278	-0.0079
AYS	0.1152	0.2035	-0.0406	-0.2729	-0.1212	0.0165

	2	3	4	5	8	12
TC	-26.112	-16.574	20.977	8.6766	3.1834	-0.2736
TS	-30.125	26.807	-37.140	-4.5335	42.736	-5.5801
QC	-3.2928	4.9751	1.6943	-0.1350	0.5166	-0.3641
QS	-0.8255	3.1672	0.4735	1.0506	-0.7317	-0.6355
TPC	23.660	25.547	-11.032	-22.995	-8.3075	-19.074
TPS	-40.673	32.100	-1.8609	-10.501	26.364	-0.0665
QPC	0.6887	0.7448	-0.3211	-0.6693	-0.2418	-0.5552
QPS	-1.1839	0.9344	-0.0542	-0.3057	0.7680	[illegible]
ATC	0.0085	-0.0439	0.5137	-0.0134	-0.0281	-0.0256
ATS	-0.1452	0.2440	-0.3380	0.0255	0.3795	-0.1013

PRELIMINARY DATA

TST-727 PH-1 TW-12..2.01:26 ID-PRESSOUTO 13 FEB 75-05:33 PAGE 16

RUN:SEQ 1028
2.01:26

		3	5	7	9	11	13
1	XC	-0.2454	-13.184	-74.557	-122.37	-105.36	-5.1764
2	XS	-72.777	-5.0938	-125.71	-22.526	44.914	64.117
3	YC	-72.777	5.0938	-125.71	22.526	44.914	-64.117
4	YS	0.2454	-13.184	74.557	-122.37	105.36	-5.1764
5	LC	-2.0383	-2.0213	1.6371	1.9405	1.9520	0.8134
6	LS	-0.9352	2.2445	0.3378	1.8509	-1.6005	0.0048
7	ZC	-0.9352	-2.2445	0.3378	-1.8508	-1.6005	-0.0048
8	ZS	2.0383	-2.0213	-1.6371	1.9405	-1.9520	0.8134
9	XPC	1.7424	0.3507	-0.4491	-0.7303	-0.0755	-0.6892
10	XPS	4.5447	-3.7054	-1.0844	-0.7690	0.5506	-1.8834
11	YPC	4.5447	3.7054	-1.0844	0.7690	0.5506	1.8834
12	YPS	-1.7424	0.3507	0.4491	-0.7303	0.0755	-0.6892
13	LPC	-23.676	-17.214	5.6960	-2.1351	-2.3154	-7.1006
14	LPS	-0.3949	5.4756	0.0554	4.7606	-1.3838	6.6574
15	ZPC	-0.6949	-5.4756	0.0554	-4.7606	-1.3838	-6.6574
16	ZPS	23.676	-17.214	-5.6960	-2.1351	2.3154	-7.1006
17	AXC	0.0936	-0.0678	-0.6057	-1.0966	-0.9097	-0.0271
18	AXS	-0.6665	-0.0986	-1.1394	-0.3710	0.4204	0.5886
19	AYC	-0.6665	0.0986	-1.1394	0.3710	0.4204	-0.5886
20	AYS	-0.0936	-0.0678	0.6057	-1.0966	0.9097	-0.0271

	2	3	4	5	8	12
TC	-21.857	26.082	49.861	49.926	35.029	4.1901
TS	-69.808	18.097	-33.751	59.347	-108.67	23.106
QC	-2.0603	2.2915	1.5462	-1.0445	-0.3412	0.9160
QS	0.4513	1.8586	-0.0221	0.0148	0.1922	0.1444
TPC	-297.47	39.012	-55.226	42.001	-37.616	12.76[illegible]
TPS	88.790	-68.653	-167.94	42.466	19.539	-25.521
QPC	-8.6589	1.1356	-1.6076	1.2400	-1.0949	0.3714
QPS	2.5845	-1.9984	-4.8865	1.2362	0.5687	-0.7429
ATC	-0.4466	0.1391	0.1037	0.4785	-0.4100	0.1342
ATS	0.0464	0.2001	-0.3136	0.1123	-0.3539	0.2343

PRELIMINARY DATA

TST-727 PH-1 TV-12--2-01:29 IO-PRESSOUTO 13 FEB 75-05:33 PAGE 17

RUN:SEQ 1029
2.01:29

		3	5	7	9	11	13
1	XC	-9.6643	-7.6125	126.35	-312.61	6.8311	71.571
2	XS	71.194	0.3365	-155.93	-167.28	-91.124	-47.924
3	YC	71.194	-0.3365	-155.93	167.28	-99.124	47.924
4	YS	9.6643	-7.6125	-126.35	-312.61	-6.8311	71.571
5	LC	1.5971	-0.7541	-1.7721	-1.4333	1.5212	0.8827
6	LS	0.9255	0.6662	0.3681	1.6210	1.6539	-0.2604
7	MC	0.9255	-0.6662	0.3481	-1.8210	1.6539	0.2604
8	MS	-1.5971	-0.7541	1.7721	-1.4333	-1.5212	0.8827
9	XPC	-18.239	0.7601	-6.5619	-0.2118	0.9531	1.4980
10	XPS	5.1156	9.2166	4.3367	-2.8365	-2.5563	1.1901
11	YPC	5.1155	-9.2165	4.3357	2.8355	-2.5583	-1.1901
12	YPS	18.239	0.7601	6.5619	-0.2118	-0.9531	1.4980
13	LPC	11.821	39.714	-7.1553	-12.264	9.5939	2.4672
14	LPS	-91.179	-20.912	-37.551	6.3371	9.1632	-8.9512
15	MPC	-91.179	20.912	-37.551	-6.3371	9.1632	8.9512
16	MPS	-11.821	39.714	7.1553	-12.264	-9.5939	2.4072
17	AXC	0.0132	-0.0025	0.0136	-2.5282	0.0259	0.6610
18	AXS	0.5516	0.0236	-1.3386	-1.5930	-0.8236	-0.4022
19	AYC	0.5515	-0.0236	-1.3386	1.5930	-0.8236	0.4022
20	AYS	-0.0132	-0.0025	-0.0136	-2.5282	-0.0259	0.6610

	2	3	4	5	8	12
TC	156.63	-58.492	63.868	14.046	-175.64	-54.779
TS	-10.172	10.205	-6.0526	15.409	66.640	-103.1[illegible]
QC	2.1246	-3.5031	-0.6743	-0.2226	0.2074	-0.2559
QS	5.2737	0.9620	-1.2296	1.1671	5.4734	0.2533
TPC	-282.59	251.28	64.067	-122.75	-6.9783	7.377[illegible]
TPS	-221.44	174.86	146.87	-35.266	42.865	15.61[illegible]
OPC	-8.2256	7.3144	1.9649	-3.5731	-0.2031	0.7147
OPS	-6.4456	5.0897	4.3335	-2.4820	1.2476	0.4546
ATC	0.1293	0.1281	1.0347	-0.0305	-1.8828	0.1943
ATS	-0.1655	0.0354	-0.1025	0.0691	-0.1037	-0.3673

PRELIMINARY DATA

TST-727 PH-1 TN-12..2.01:30   IU-PRESSUUTO   13 FEB 75A05:33   PAGE 18

RUN:SEQ 1030
2.01:30

		3	5	7	9	11	13
1	XC	16.203	-9.3715	-5.3344	-53.952	-8.4336	-23.946
2	XS	89.374	28.289	-28.318	34.501	49.666	21.629
3	YC	89.374	-28.289	-28.318	-34.501	49.666	-21.629
4	YS	-16.203	-9.3715	5.3344	-53.952	8.4336	-23.946
5	LC	1.6352	1.3874	-0.0501	3.4161	2.6048	1.4295
6	LS	2.1620	0.3597	-3.4302	0.0746	-0.6508	2.1498
7	NC	2.1620	-0.3574	-3.4302	-0.0746	-0.6508	-2.1498
8	NS	-1.6352	1.3874	0.0501	3.4161	-2.6048	1.4295
9	XFC	-4.6677	0.4504	0.3188	0.3261	-0.4751	0.3097
10	XFS	3.5499	5.3951	0.6612	-0.7165	0.4664	-0.1221
11	YFC	3.5499	5.3951	0.6612	0.7165	0.4664	0.1221
12	YFS	4.6677	0.4504	-0.3188	0.3261	0.4751	0.3097
13	LFC	-7.0139	23.237	-3.4693	-3.6191	-1.1798	-1.1339
14	LFS	-27.532	-12.266	0.2150	-0.0943	-3.0160	-1.1511
15	NFC	-27.532	12.266	0.2150	0.0943	-3.0160	1.1511
16	NFS	7.0139	23.237	3.4693	-3.6191	1.1798	-1.1339
17	AXC	-0.0068	-0.0301	-0.0705	-0.4507	-0.0707	-0.1830
18	AXS	0.6103	0.1405	-0.1400	0.2829	0.4956	0.2039
19	AYC	0.6103	-0.1405	-0.1400	-0.2829	0.4956	-0.2039
20	AYS	0.0068	-0.0301	0.0705	-0.4507	0.0707	-0.1830

	2	3	4	5	8	12
TC	-11.330	-117.58	-93.204	-3.0542	-51.165	11.266
TS	3.7054	-5.9142	-110.97	0.2745	-25.184	-4.8191
UC	-2.9054	2.4529	-11.864	-2.2180	-3.3710	1.2711
CS	-2.3181	3.2482	-8.0036	1.2136	0.1381	-1.2957
TPC	-71.311	92.047	-16.314	-71.909	-12.694	1.9273
TPS	13.491	21.466	11.232	-49.645	-6.1745	4.0540
OPC	-2.0757	2.5793	-0.4894	-2.1932	-0.3695	0.0563
UPS	0.3927	0.6249	0.3269	-1.4509	-0.2379	[illegible]
ATC	-0.3356	-1.1919	-0.6199	0.1086	-0.4490	[illegible]
ATS	-0.1306	-0.0207	-0.9274	0.0549	-0.3756	-0.0396

PRELIMINARY DATA

TST-727 PR-1 TN-12..2.01:31 II-PRESSURTO 13 FEB 75 05:33 PAGE 19

RUN SEQ 1031
2.01:31

		3	5	7	9	11	13
1	XC	42.294	23.163	21.096	-5.3951	11.442	-5.2911
2	XS	61.414	[illegible]	[illegible]	2.2135	[illegible]	11.637
3	YC	61.814	-38.076	[illegible]	-2.2135	8.5496	-11.637
4	YS	-42.294	23.165	-21.096	-5.3951	-11.442	-5.2911
5	LC	5.1323	0.0843	-1.0344	1.3122	-0.1034	0.1871
6	LS	[illegible]	0.3765	[illegible]	-0.7922	[illegible]	0.9685
7	NC	3.0386	-0.3755	[illegible]	0.7922	[illegible]	-0.9685
8	NS	-5.1323	0.0843	1.0344	1.3122	0.1034	0.1871
9	XPC	6.0594	4.4020	1.7695	-0.7550	-0.0239	0.2425
10	XPS	6.5444	0.4549	-2.0108	0.9751	0.3567	-0.2649
11	YPC	6.5444	-0.4544	[illegible]	-0.9751	0.3567	0.2649
12	YPS	[illegible]	4.4020	-1.7695	-0.7950	0.0239	[illegible]
13	LPC	-30.478	-6.3173	5.6162	5.8655	-1.5564	-1.7201
14	LPS	-9.4942	-20.530	11.724	[illegible]	-0.7584	-0.7594
15	NPC	-9.4942	20.530	11.724	[illegible]	-0.7584	0.7594
16	NPS	30.478	-6.3173	-5.6162	5.8655	1.5564	-1.7201
17	AXC	0.0619	0.2025	0.0403	-0.0741	0.1139	0.0263
18	AXS	0.6205	0.3405	0.1738	-0.0047	0.0553	0.0959
19	AYC	0.6205	-0.3405	0.1738	0.0047	0.0553	-0.0959
20	AYS	-0.0619	0.2025	-0.0403	-0.0741	-0.1139	0.0263

	2	3	4	5	8	12
TC	29.342	-133.69	-123.76	58.451	-3.7313	3.7686
TS	-24.505	39.284	39.472	[illegible]	6.0756	[illegible]
QC	-1.1332	2.8273	-11.469	-1.0264	1.5701	0.7091
QS	1.0284	-2.1674	8.0893	0.4700	1.4416	[illegible]
TPC	-135.58	74.833	-28.843	-50.975	-3.3230	[illegible]
TPS	85.201	-75.496	-25.122	50.177	13.425	[illegible]
QPC	-3.9454	2.1763	[illegible]	[illegible]	-0.0567	[illegible]
QPS	2.4801	-2.1976	-0.7312	1.4606	[illegible]	[illegible]
ATC	-0.1062	-1.3239	-0.9156	0.6479	0.1062	[illegible]
ATS	-0.2062	0.6626	0.4917	-0.4747	0.1135	[illegible]

PRELIMINARY DATA

TST-727 PH-1 TN-12..2.01:33   ID-PRESSUUTO   13 FEB 75 05:33   PAGE 20

RUN:SEQ 1033
2.01:33

		3	5	7	9	11	13
1	XC	-23.405	19.918	4.4563	-3.8073	23.548	-10.850
2	XS	-38.589	-46.896	11.489	-36.824	17.922	8.6138
3	YC	-38.589	46.896	11.489	36.824	17.922	-8.6138
4	YS	23.405	19.918	-4.4563	-3.8073	-23.548	-10.850
5	LC	-3.6001	6.5599	0.3854	0.4951	1.6907	0.9631
6	LS	0.8763	2.1037	1.4033	3.5471	1.0813	0.4456
7	MC	0.8763	-2.1037	1.4033	-3.5471	1.0813	-0.4456
8	MS	3.6001	6.5599	-0.3854	0.4951	-1.6907	0.9631
9	XPC	-1.9775	-0.4692	-0.6025	-0.1241	-0.0713	0.4398
10	XPS	-4.2149	0.5040	-2.0102	-0.5319	-1.7108	-0.3199
11	YPC	-4.2149	-0.5040	-2.0102	0.5319	-1.7108	0.3199
12	YPS	1.9775	-0.4692	0.6025	-0.1241	0.0713	0.4398
13	LPC	22.581	3.1420	10.122	-2.1396	7.7754	-2.2644
14	LPS	-0.6197	1.1373	1.1301	1.5659	2.9335	-1.3559
15	MPC	-0.6197	-1.1373	1.1301	-1.5659	2.9335	1.3559
16	MPS	-22.581	3.1420	-10.122	-2.1396	-7.7754	-2.2644
17	AXC	-0.0845	0.3062	0.0146	-0.0294	0.1606	-0.1023
18	AXS	-0.3530	-0.5101	0.1760	-0.2942	0.1153	0.1214
19	AYC	-0.3530	0.5101	0.1760	0.2942	0.1153	-0.1214
20	AYS	0.0845	0.3062	-0.0146	-0.0294	-0.1606	-0.1023

	2	3	4	5	6	12
TC	28.221	23.337	-70.491	-48.756	-5.0636	-33.234
TS	-8.2858	-16.360	34.612	-68.866	13.401	-12.554
QC	1.5078	-3.0019	-1.3277	-2.0822	0.3288	-1.0285
QS	-0.5991	2.9983	-0.0503	-6.5176	1.1440	1.4141
TPC	-12.096	-32.233	59.415	-1.4621	-0.0665	10.567
TPS	-12.893	67.988	6.5130	-11.032	38.746	10.633
QPC	-0.3521	-0.9382	1.7295	-0.0426	-0.0019	0.3076
QPS	-0.3753	1.9790	0.1896	-0.3211	1.1278	0.3153
ATC	0.4246	0.2184	-0.7553	-0.3990	-0.0574	-0.2672
ATS	-0.1049	-0.3551	0.6894	-0.3356	0.0427	-0.1257

PRELIMINARY DATA

TST-727 PH-1 TN-12..2.01:34 ID-PRESSAUTO 13 FEB 75 05:33 PAGE 21

RUN:SEQ 1634
2.01:34

		3	5	7	9	11	13
1	XC	46.411	16.192	1.5819	-16.072	8.2788	-22.148
2	XS	57.156	32.531	16.968	32.260	30.527	24.951
3	YC	57.156	-32.531	16.968	-32.260	30.527	-24.951
4	YS	-46.411	16.192	-1.5819	-16.072	-8.2788	-22.148
5	LC	5.0119	0.9958	-0.5563	1.8511	-0.4190	0.2066
6	LS	1.3457	1.5905	-0.5410	-1.2693	-2.2452	0.1634
7	MC	1.3457	-1.5905	-0.5410	1.2693	-2.2452	-0.1634
8	MS	-5.0119	0.9958	0.5563	1.8511	0.4190	0.2066
9	XFC	-0.2464	4.0034	1.3027	-1.1269	0.1142	-0.1681
10	XPS	5.3288	0.9581	-1.0311	0.4173	0.0942	-0.0746
11	YFC	5.3288	-0.9581	-1.0311	-0.4173	0.0942	0.0746
12	YPS	0.2464	4.0034	-1.3029	-1.1269	-0.1142	-0.1681
13	LPC	-23.328	-3.3308	2.1279	4.0055	-0.6376	-0.0137
14	LPS	-11.229	-19.699	7.7781	4.2391	0.3311	0.6924
15	MPC	-11.229	19.699	7.7781	-4.2391	0.3311	-0.6924
16	MPS	23.328	-3.3308	-2.1279	4.0055	0.6376	-0.0137
17	AXC	0.1450	0.1310	0.0137	-0.1341	0.0857	-0.1454
18	AXS	0.4603	0.2864	0.1518	0.2259	0.3136	0.1538
19	AYC	0.4603	-0.2864	0.1518	-0.2259	0.3136	-0.1538
20	AYS	-0.1450	0.1310	-0.0137	-0.1341	-0.0857	-0.1454

	2	3	4	5	8	12
TC	15.954	-80.812	-104.21	25.553	13.236	-3.8273
TS	-11.566	44.953	6.2934	-41.135	10.107	-12.935
QC	-1.8216	3.0034	-10.866	-3.3501	0.4397	-0.2694
QS	-0.6604	-0.5519	4.0529	3.9024	0.2437	0.2645
TPC	-114.64	68.985	-17.678	-53.101	-2.6534	6.8453
TPS	59.083	-51.706	-13.292	40.075	10.748	-0.8640
QPC	-3.3371	2.0060	-0.5146	-1.5457	-0.0774	0.1663
QPS	1.7193	-1.5051	-0.3869	1.1695	0.4875	-0.0251
ATC	-0.1098	-0.6005	-0.7089	0.3514	0.1147	0.0134
ATS	-0.2221	0.8444	0.0159	-0.3319	0.0561	-0.0281

ORIGINAL PAGE IS
OF POOR QUALITY

PRELIMINARY DATA

TST-727 PH-1 TN-12..2.01:35 ID-PRESSUUTO 13 FEB 75005:33 PAGE 22

RUN:SEQ 1035
2.01:35

		3	5	7	9	11	13
1	XC	-2.2780	14.567	44.702	8.6616	29.042	50.024
2	XS	101.85	53.743	-45.247	-69.820	-34.894	-13.693
3	YC	101.85	-53.743	-45.247	69.820	-34.894	13.693
4	YS	2.2780	14.567	-44.702	8.6616	-29.042	50.024
5	LC	3.6078	-0.3585	0.1683	1.1546	0.6775	0.0981
6	LS	2.7258	-2.1778	1.9345	3.4620	-1.1130	-1.8545
7	MC	2.7258	2.1778	1.9345	-3.4620	-1.1130	1.8545
8	MS	-3.6078	-0.3585	-0.1683	1.1546	-0.6775	0.0981
9	XPC	-3.9819	1.3712	-0.6952	-0.2444	-0.2346	0.2162
10	XPS	4.8822	3.3819	1.6386	-0.6779	0.2329	-0.0610
11	YPC	4.8822	-3.3819	1.6386	0.6779	0.2329	0.0610
12	YPS	3.9819	1.3712	0.6952	-0.2444	0.2346	0.2162
13	LPC	-14.234	11.546	-5.9959	-2.5627	-0.5942	-0.6832
14	LPS	-27.091	-14.784	-6.2191	2.3798	-1.4905	-0.8496
15	MPC	-27.091	14.784	-6.2191	-2.3798	-1.4905	0.8496
16	MPS	14.234	11.546	5.9959	-2.5627	0.5942	-0.6832
17	AXC	-0.1593	0.1534	0.3696	0.0439	0.2275	0.3799
18	AXS	0.5946	0.4280	-0.3362	-0.5818	-0.2587	-0.1323
19	AYC	0.5946	-0.4280	-0.3362	0.5818	-0.2587	0.1323
20	AYS	0.1593	0.1534	-0.3696	0.0439	-0.2275	0.3799

	2	3	4	5	8	12
TC	-37.582	-147.70	-75.423	63.769	30.656	22.608
TS	-18.935	-44.507	-61.789	14.453	-67.359	-27.095
QC	-3.7484	-1.5818	-14.624	1.5209	-2.0504	1.2055
QS	-3.6444	-0.4628	-3.0620	0.0186	2.1231	-0.3540
TPC	-162.43	101.82	-47.053	-61.409	7.5764	-1.3957
TPS	-6.3801	-0.5317	-27.116	-11.431	10.364	-11.365
QPC	-4.7280	2.9637	-1.3696	-1.7875	0.2205	-0.0406
QPS	-0.1857	-0.0155	-0.7893	-0.3327	0.3018	-0.3306
ATC	-0.5735	-1.5448	-0.4393	0.7089	0.3087	0.2721
ATS	-0.1293	-0.0805	-0.4637	0.3697	-0.8090	-0.4795

TST-727 PH-1 TH-12..2.01:41 ID-PRESSUUTU 13 FEB 75005:33 PAGE 23

RUN:SEQ 1041
2.01:41

		3	5	7	9	11	13
1	XC	-90.691	2.8307	14.438	-19.204	40.942	14.064
2	XS	-65.657	-9.6360	-69.825	-25.251	-17.628	-24.357
3	YC	-65.657	9.0368	-69.825	25.251	-17.628	24.357
4	YS	90.691	2.8307	-14.838	-19.204	-40.942	14.064
5	LC	3.1806	3.8704	0.6239	1.2711	-1.9752	0.6474
6	LS	10.967	-2.5175	-0.6076	0.3721	-1.3985	-0.3767
7	MC	10.967	2.5175	-0.6076	-0.3721	-1.3985	0.3767
8	MS	-3.1806	3.8704	-0.6239	1.2711	1.9752	0.6474
9	XPC	3.4943	-1.7897	-0.3255	0.1541	-0.5266	-0.0033
10	XPS	-0.3598	-1.3759	0.8668	0.5231	-0.0077	0.0347
11	YPC	-0.3598	1.3759	0.8668	-0.5231	-0.0077	-0.0347
12	YPS	-3.4943	-1.7897	0.3255	0.1541	0.5266	-0.0033
13	LPC	-5.0345	-2.7426	-3.2222	2.0432	1.0353	0.1615
14	LPS	16.236	10.607	-3.1012	-1.6825	-2.3368	-0.0511
15	MPC	16.236	-10.607	-3.1012	1.6825	-2.3368	0.0511
16	MPS	5.0345	-2.7426	3.2522	2.0432	-1.0353	0.1615
17	AXC	-0.0327	-0.0882	0.2207	-0.1365	0.4321	0.0804
18	AXS	-0.4873	-0.1789	-0.5712	-0.2555	-0.1661	-0.2370
19	AYC	-0.4673	0.1789	-0.5712	0.2555	-0.1661	0.2370
20	AYS	0.0327	-0.0682	-0.2207	-0.1365	-0.4321	0.0804

	2	3	4	5	8	12
TC	-60.526	34.871	69.842	-20.760	4.6082	-22.545
TS	-41.199	15.460	96.621	36.397	9.9111	-6.912
QC	-2.3674	-3.5232	2.3033	1.6471	-0.2119	0.0160
QS	1.1215	4.6865	1.6265	0.3152	0.6516	0.6041
TPC	-15.485	-40.407	-63.934	35.556	-2.5255	5.3032
TPS	98.825	-39.676	11.431	-8.1745	-1.7280	-1.3957
QPC	-0.4507	-1.1762	-1.8610	1.0350	-0.0735	0.1567
QPS	2.8766	-1.1697	0.3327	-0.2379	-0.0503	-0.0406
ATC	-0.9286	0.6126	0.7956	-0.1379	0.0073	-0.1762
ATS	-0.0525	0.2416	0.6492	0.1476	0.0708	-0.2221

ORIGINAL PAGE IS OF POOR QUALITY

PRELIMINARY DATA

RUN:SEQ 1092
2.01:42

		3	5	7	9	11	13
1	XC	-92.653	-41.807	-3.4830	-22.698	31.253	18.920
2	XS	49.990	45.360	27.935	9.9148	1.3682	-8.3659
3	YC	49.990	-45.360	27.935	-9.9148	1.3682	8.3659
4	YS	92.653	-41.807	3.4830	-22.698	-31.253	18.920
5	LC	-3.5904	5.2482	-1.2209	4.6170	-0.6414	0.6712
6	LS	1.6190	-2.0209	-2.2319	-4.1273	-0.7584	0.4782
7	MC	1.6190	2.0209	-2.2319	4.1273	-0.7584	-0.4782
8	MS	3.5904	5.2482	1.2209	4.6170	0.6414	0.6712
9	XPC	-7.0938	1.3397	-0.8001	0.7258	0.5314	0.2452
10	XPS	1.0219	-0.1398	0.2465	-0.4384	-0.3667	-0.3620
11	YPC	1.0219	0.1398	0.2465	0.4384	-0.3667	0.3620
12	YPS	7.0938	1.3397	0.8001	0.7258	-0.5314	0.2452
13	LPC	8.9193	-3.1705	0.4200	-3.3373	0.6274	-2.0826
14	LPS	-33.620	-5.7170	-4.0413	-2.4078	3.0700	-0.4069
15	MPC	-33.620	5.7170	-4.0413	2.4078	3.0700	0.4069
16	MPS	-8.9193	-3.1705	-0.4200	-3.3373	-0.6274	-2.0826
17	AXC	-0.4808	-0.3373	-0.0719	-0.1507	0.2731	0.2150
18	AXS	0.1355	0.2152	0.2283	0.0339	0.0531	-0.0787
19	AYC	0.1355	-0.2152	0.2283	-0.0339	0.0531	0.0787
20	AYS	0.4808	-0.3373	0.0719	-0.1507	-0.2731	0.2150

	2	3	4	5	8	12
TC	4.9223	-51.896	61.953	-39.420	8.1520	1.3112
TS	-57.376	-63.094	39.114	125.65	15.378	-26.294
QC	0.4915	2.8451	-1.7193	1.7491	0.0457	-1.9024
QS	-3.4807	0.9727	-0.5008	11.184	1.1839	0.5196
TPC	-57.355	85.656	-32.632	-12.029	-6.4466	5.4497
TPS	-40.075	77.957	-27.315	18.143	-9.2379	3.7217
QPC	-1.6695	2.4936	-0.9498	-0.3501	-0.1876	0.1586
QPS	-1.1665	2.2692	-0.7951	0.5281	-0.2689	0.1083
ATC	-0.1537	-0.8603	0.7683	0.0769	0.0232	-0.0195
ATS	-0.6174	-0.2745	0.2562	0.8725	0.0061	-0.4149

PRELIMINARY DATA

TST-727 PH-1 TN-12..2.01:43 ID-PRESSUUTO 13 FEB 75005:33 PAGE 25

RUN:SEQ 1043
2.01:43

		3	5	7	9	11	13
1	XC	35.699	55.755	43.982	-1.3904	10.478	10.534
2	XS	-38.195	31.067	-24.870	29.722	40.435	-30.115
3	YC	-38.195	-31.067	-24.870	-29.722	40.485	30.115
4	YS	-35.699	55.755	-43.982	-1.3904	-10.478	10.534
5	LC	3.9518	6.5069	-1.1939	2.3555	-0.1119	1.0802
6	LS	-6.4464	-1.7853	-2.4439	-1.1455	-3.3514	-0.6884
7	MC	-6.4464	1.7853	-2.4439	1.1455	-3.3514	0.6884
8	MS	-3.9518	6.5069	1.1939	2.3555	0.1119	1.0802
9	XPC	3.1133	1.5893	-0.4950	0.5080	0.1337	-0.2509
10	XPS	0.1735	-1.8217	-0.1042	-0.6639	-0.0070	-0.5500
11	YPC	0.1735	1.8217	-0.1042	0.6639	-0.0070	0.5500
12	YPS	-3.1133	1.5893	0.4950	0.5080	-0.1337	-0.2509
13	LPC	-6.6919	-11.156	1.4063	-3.9301	-0.2227	-1.9792
14	LPS	13.573	-3.6348	-2.0122	-1.0065	0.6104	2.1656
15	MPC	13.573	3.6348	-2.0122	1.0065	0.6104	-2.1656
16	MPS	6.6919	-11.156	-1.4063	-3.9301	0.2227	-1.9792
17	AXC	0.1535	0.5007	0.3847	-0.0474	0.1680	0.1064
18	AXS	-0.0911	0.1395	-0.1522	0.2327	0.3483	-0.2371
19	AYC	-0.0911	-0.1395	-0.1522	-0.2327	0.3483	0.2371
20	AYS	-0.1535	0.5007	-0.3847	-0.0474	-0.1680	0.1064

	2	3	4	5	8	12
TC	-59.994	56.523	105.04	-61.005	-15.504	-11.057
TS	-84.581	43.411	151.94	7.3243	129.89	8.1506
QC	-1.2350	-4.9803	4.5019	3.3019	1.1643	0.2034
QS	0.3625	-2.6558	2.2679	4.0553	-1.3868	0.9764
TPC	-90.983	-29.840	-70.181	6.3801	9.0365	-1.6615
TPS	181.37	-40.607	-21.932	36.547	5.9814	-0.7311
QPC	-2.6484	-0.8686	-2.0429	0.1857	0.2631	-0.0484
QPS	5.2793	-1.1820	-0.6384	1.1220	0.1741	-0.0213
ATC	-0.9383	0.8114	1.1116	0.0232	-0.1989	-0.2440
ATS	-0.3990	0.7431	1.3703	0.1086	1.1311	0.1562

PRELIMINARY DATA

TST-727 PH-1 TN-12..2.01:44 ID-PRESSOUTO 13 FEB 75.05:33 PAGE 26

RUN:SEQ 1044
2.01:44

		3	5	7	9	11	13
1	XC	87.424	1.1727	40.196	-21.545	-5.3180	35.967
2	XS	70.894	27.977	-33.515	35.049	-33.983	17.315
3	YC	70.894	-27.977	-33.515	-35.049	-33.983	-17.315
4	YS	-87.424	1.1727	-40.196	-21.545	5.3180	35.967
5	LC	10.691	-1.3432	-3.0778	2.2412	-0.8569	0.1520
6	LS	3.0718	-0.7810	0.0998	-2.9873	-0.4938	-0.0078
7	MC	3.0718	0.7810	0.0998	2.9873	-0.4938	0.0078
8	MS	-10.691	-1.3432	3.0778	2.2412	0.8569	0.1520
9	XPC	0.6195	5.3192	2.3933	-0.1560	-0.1279	0.0243
10	XPS	6.6760	1.2433	1.6158	-0.5642	1.0990	0.4756
11	YPC	6.6760	-1.2433	1.6158	0.5642	1.0990	-0.4756
12	YPS	-0.6195	5.3192	-2.3933	-0.1560	0.1279	0.0243
13	LPC	-30.994	-4.5354	-11.764	-2.2231	-4.6648	2.0776
14	LPS	-9.9237	-26.126	7.6164	1.7690	-2.6599	-1.0125
15	MPC	-9.9237	26.126	7.6164	-1.7690	-2.6599	1.0125
16	MPS	30.994	-4.5354	11.764	-2.2231	4.6648	2.0776
17	AXC	0.2583	0.0645	0.2630	-0.2437	-0.0508	0.3368
18	AXS	0.6246	0.2453	-0.3522	0.3090	-0.3094	0.1648
19	AYC	0.6245	-0.2453	-0.3522	-0.3090	-0.3094	-0.1648
20	AYS	-0.2553	0.0645	-0.2630	-0.2437	0.0508	0.3368

	2	3	4	5	8	12
TC	-11.026	-105.09	-124.65[illegible]	99.782	-3.0483	-11.2[illegible]
TS	-19.537	149.33	35.757	-63.197	-48.612	-21.47[illegible]
QC	-3.3147	0.0559	-5.1140	-1.7594	-0.3598	0.2233
QS	-1.6368	0.6872	15.587	0.1360	3.4038	-0.7576
TPC	-223.30	76.894	-24.969	-70.248	26.046	3.2565
TPS	63.270	-76.362	-5.5826	53.500	-0.6046	9.5137
QPC	-6.5000	2.2382	-0.7274	-2.0449	0.8164	0.09[illegible]
QPS	1.8417	-2.2228	-0.1625	1.5573	-0.0193	0.2766
ATC	-0.4137	-1.1324	-0.5967	1.2483	-0.1062	0.1391
ATS	-0.1110	1.5669	0.0720	-0.5869	-0.4137	0.0244

PRELIMINARY DATA

TST-727 PH-I TN-12..2.01:45 ID-PRESSUUTO 13 FEB 75A05:33 PAGE 27

RUN:SEQ 1045
2.01:45

		3	5	7	9	11	13
1	XC	-69.185	-25.464	-11.379	21.573	5.2520	2.8934
2	XS	-32.431	9.1348	37.036	2.1144	9.6554	13.985
3	YC	-32.431	-9.1348	37.036	-2.1144	9.6554	-13.985
4	YS	69.185	-25.464	11.379	21.573	-5.2520	2.8934
5	LC	-2.8339	4.9500	0.5278	0.6669	-1.9360	0.0392
6	LS	4.8101	-0.8819	-1.1949	2.1418	1.1251	-1.2527
7	MC	4.8101	0.8819	-1.1949	-2.1418	1.1251	1.2527
8	MS	2.8339	4.9500	-0.5278	0.6669	1.9360	0.0392
9	XPC	-4.6353	-0.0239	0.6437	-0.6893	0.2811	0.2569
10	XPS	-2.5100	-1.2175	-1.3240	0.1206	-0.1147	0.0014
11	YPC	-2.5100	1.2175	-1.3240	-0.1206	-0.1147	-0.0014
12	YPS	4.6353	-0.0239	-0.6437	-0.6893	-0.2811	0.2569
13	LPC	20.019	-5.3930	4.6489	1.8487	-0.0220	-0.4822
14	LPS	-15.929	2.4167	5.3911	2.6492	1.4732	-1.1500
15	MPC	-15.929	-2.4167	5.3911	-2.6492	1.4732	1.1500
16	MPS	-20.019	-5.3930	-4.6489	1.8487	0.0220	-0.4822
17	AXC	-0.4152	-0.1575	-0.1464	0.1533	0.0223	0.0046
18	AXS	-0.4220	-0.0681	0.2527	-0.1097	0.0895	0.0952
19	AYC	-0.4220	0.0681	0.2527	0.1097	0.0895	-0.0952
20	AYS	0.4152	-0.1575	0.1464	0.1533	-0.0223	0.0046

	2	3	4	5	8	12
TC	13.962	53.440	71.600	-102.74	-12.635	-71.020
TS	-63.329	-74.303	59.621	61.043	8.8442	-26.013
QC	1.3347	2.9401	4.4639	-4.0918	-1.1201	-0.2396
QS	-2.9599	2.3125	-1.4530	5.8176	1.4274	0.0992
TPC	-38.680	16.349	23.312	15.419	5.7620	7.0447
TPS	-10.766	83.606	-32.299	12.229	20.602	-3.0571
QPC	-1.1259	0.4759	0.8241	0.4488	0.1083	0.2051
QPS	-0.3134	2.4336	-0.9402	0.3560	0.6055	-0.0890
ATC	0.2282	0.0451	0.5735	-0.7785	0.0757	-0.0150
ATS	-0.8041	-0.6772	0.6540	0.3441	-0.0268	-0.2855

PRELIMINARY DATA

ORIGINAL PAGE IS
OF POOR QUALITY

RUN:SEQ 1046
2.01:46

		3	5	7	9	11	13
1	XC	-28.796	-30.627	-4.8722	-2.8996	-34.867	38.423
2	XS	92.402	31.307	-3.8262	-40.469	1.6920	-20.926
3	YC	92.402	-31.307	-3.8262	40.469	1.6920	20.926
4	YS	28.796	-30.627	4.8722	-2.8996	34.867	38.423
5	LC	4.0150	0.5293	0.9077	0.8440	2.6149	-1.2121
6	LS	1.9770	1.3791	3.1044	1.1709	-0.0810	0.6993
7	PC	1.9776	-1.3791	3.1044	-1.1709	-0.0810	-0.6993
8	PS	-4.0160	0.5293	-0.9077	0.8440	-2.6149	-1.2121
9	XPC	-3.0823	-0.2260	-1.1838	-0.1368	0.3226	-0.1620
10	XPS	3.3641	3.6535	1.0546	-1.0064	-0.2297	-0.6232
11	YPC	3.3641	-3.6535	1.0546	1.0064	-0.2297	0.6232
12	YPS	3.0823	-0.2260	1.1838	-0.1368	-0.3220	-0.1620
13	LPC	-9.1646	17.663	-2.4596	-4.2342	0.4127	-2.4752
14	LPS	-20.158	-6.3343	-7.2910	2.5237	1.8772	1.9060
15	PPC	-20.158	6.3343	-7.2910	-2.5237	1.8772	-1.9060
16	PPS	9.1646	17.663	2.4596	-4.2342	-0.4127	-2.4752
17	AXC	-0.3927	-0.2637	-0.0884	-0.0014	-0.2727	0.3182
18	AXS	0.6347	0.2356	-0.0823	-0.3272	0.0977	-0.1420
19	AYC	0.6347	-0.2356	-0.0823	0.3272	0.0977	0.1420
20	AYS	0.3927	-0.2637	0.0884	-0.0014	0.2727	0.3182

	2	3	4	5	8	12
TC	-3.6062	-136.92	-132.56	44.122	17.037	51.659
TS	30.983	-29.272	-83.420	9.1603	-85.462	20.140
UC	-5.2158	1.1404	-4.3908	-2.5734	-1.6574	1.3715
US	-2.0638	0.9803	-1.6265	1.9663	0.4943	-2.1024
TPC	-123.61	73.637	-8.5066	-45.857	-23.261	-12.76
TPS	24.723	3.8547	-21.134	-42.534	-15.552	6.3601
OPC	-3.5982	2.1434	-0.2476	-1.3348	-0.6771	-0.3714
OPS	0.7196	0.1122	-0.6152	-1.2381	-0.4527	0.1557
ATC	-0.2270	-1.4216	-0.8664	0.6101	0.0427	0.4320
ATS	0.0537	-0.1403	-0.7419	0.1952	-0.4771	0.3343

PRELIMINARY DATA

RUN:SEQ 1047
2.01:47

		3	5	7	9	11	13
1	XC	-31.747	-42.135	-12.291	-17.861	-120.84	-17.993
2	XS	83.804	67.149	8.5304	6.9099	1.3013	-14.871
3	YC	83.804	-67.149	8.5304	-6.9099	1.3013	14.871
4	YS	31.747	-42.135	-12.291	-17.861	120.84	-17.993
5	LC	4.3274	0.2364	0.2361	-0.2043	6.1640	-1.7498
6	LS	1.4293	0.1887	1.2745	1.1135	2.6607	0.8464
7	MC	1.4293	-0.1887	1.2745	-1.1135	2.6607	-0.5464
8	MS	-4.3274	0.2364	-0.2351	-0.2043	-6.1640	-1.7498
9	XPC	-3.3074	0.8745	-1.3475	-0.3902	-0.3201	-0.1289
10	XPS	3.9993	3.1749	1.3513	-0.6003	-0.2905	0.1862
11	YPC	3.9993	-3.1749	1.3513	0.6003	-0.2905	-0.1862
12	YPS	3.3074	0.8745	1.3475	-0.3902	0.3201	-0.1289
13	LPC	-11.573	12.516	-5.6300	-2.2961	1.9057	1.0767
14	LPS	-22.371	-9.9396	-9.7150	3.0355	-0.8773	0.2218
15	MPC	-22.371	9.9396	-9.7150	-3.0355	-0.8773	-0.2218
16	MPS	11.573	12.516	5.6300	-2.2961	-1.9057	1.0767
17	AXC	-0.3866	-0.3097	-0.1268	-0.1219	-1.1196	-0.1618
18	AXS	0.5465	0.5369	0.0795	0.0758	0.1150	-0.1160
19	AYC	0.5465	-0.5369	0.0795	-0.0758	0.1150	0.1160
20	AYS	0.3866	-0.3097	0.1268	-0.1219	1.1196	-0.1618

	2	3	4	5	8	12
TC	-11.740	-146.06	-151.80	76.042	-51.636	98.633
TS	1.7124	-16.861	-71.134	-3.5936	-94.406	1.1460
QC	-5.2230	2.0168	-9.1636	-1.3384	-2.2949	-1.1192
QS	-3.7982	1.0258	1.5593	1.3195	4.0314	0.1349
TPC	-166.95	83.872	-9.9687	-48.532	-24.774	[illegible]
TPS	24.457	0.1329	-33.303	-21.732	-3.6547	-0.1329
QPC	-4.8595	2.4414	-0.2902	-1.4141	-0.8667	0.0116
QPS	0.7119	0.0039	-0.9711	-0.6326	-0.1122	-0.0039
ATC	-0.3929	-1.7107	-0.9933	1.8322	-0.5711	0.8139
ATS	-0.1342	0.2050	-0.6565	-0.0976	-0.2977	-0.0647

PRELIMINARY DATA

RUNISEQ 1048
2.01:48

		3	5	7	9	11	13
1	XC	-9.5268	13.786	6.6273	-6.3704	8.6642	17.843
2	XS	81.406	33.601	14.153	2.3262	-20.328	-40.437
3	YC	81.406	-33.601	14.153	-2.3262	-20.328	40.437
4	YS	9.5268	13.786	-6.6273	-6.3704	-8.6642	17.843
5	LC	0.9364	0.6976	-0.7009	-0.9201	-0.6927	-0.1537
6	LS	4.3167	-0.1878	-1.9297	0.3724	-0.9222	0.2016
7	MC	4.3167	0.1878	-1.9297	-0.3724	-0.9222	-0.2016
8	MS	-0.9364	0.6976	0.7009	-0.9201	0.6927	-0.1537
9	XPC	0.4093	2.9780	2.0278	-1.5970	-0.3596	-0.0217
10	XPS	4.9793	1.5955	0.6110	0.2026	0.3910	0.7107
11	YPC	4.9793	-1.5955	0.6110	-0.2026	0.3910	-0.7107
12	YPS	-0.4093	2.9780	-2.0278	-1.5970	0.3596	-0.0217
13	LPC	-23.014	1.4647	-6.5427	3.9402	-1.0626	3.2150
14	LPS	-7.6360	-16.331	7.6939	6.7465	-2.3492	-1.2539
15	MPC	-7.6360	16.331	7.6939	-6.7465	-2.3492	1.2539
16	MPS	23.014	1.4647	6.5427	3.9402	1.0626	3.2150
17	AXC	-0.2174	0.1286	0.1143	-0.0274	0.1278	0.1937
18	AXS	0.5216	0.3202	0.1353	-0.0018	-0.2357	-0.3294
19	AYC	0.5216	-0.3202	0.1353	0.0018	-0.2357	0.3294
20	AYS	0.2174	0.1286	-0.1143	-0.0274	-0.1278	0.1937

	2	3	4	5	8	12
TC	-18.182	-144.22	-134.84	79.068	-10.751	7.1996
TS	-13.319	-0.9602	-41.307	-61.049	-41.336	8.5366
QC	-3.7714	0.1498	-3.8986	0.0969	0.6044	-0.9542
QS	-0.8520	1.9648	3.9490	0.2795	2.4964	-1.4352
TPC	-104.41	57.886	-33.629	-50.509	7.0447	0.7311
TPS	57.753	-56.291	-14.222	20.735	22.995	3.7842
QPC	-3.0391	1.6850	-0.9789	-1.4702	0.2051	0.0213
QPS	1.6811	-1.6385	-0.4140	0.6036	0.6693	0.1103
ATC	-0.2807	-1.4521	-0.8822	0.9603	-0.3002	-0.0376
ATS	-0.1660	0.3783	-0.4381	-0.4747	-0.0561	0.0642

PRELIMINARY DATA

TST-727 PH-1 TN-12..2.01:49 ID-PRESSAUTO 13 FEB 75205:33 PAGE 31

RUN:SEQ 1049
2.01:49

		3	5	7	9	11	13
1	XC	-19.852	-6.4736	-23.422	-54.753	-25.198	4.0466
2	XS	62.611	67.749	29.977	-29.319	34.132	-11.660
3	YC	62.611	-67.749	29.977	29.319	34.132	11.660
4	YS	19.852	-6.4736	23.422	-54.753	25.198	4.0466
5	LC	1.3134	0.4320	0.4924	1.5581	1.0545	0.2970
6	LS	2.6952	0.1241	2.4133	3.0493	-1.5190	1.7398
7	MC	2.6952	-0.1241	2.4133	-3.0493	-1.5190	-1.7398
8	MS	-1.3134	0.4320	-0.4924	1.5581	-1.0545	0.2970
9	XPC	0.4509	2.8677	1.3917	0.1027	0.3614	-0.0268
10	XPS	5.4719	2.2295	-0.4729	0.0858	1.0227	0.2779
11	YPC	5.4719	-2.2295	-0.4729	-0.0858	1.0227	-0.2779
12	YPS	-0.4509	2.8677	-1.3917	0.1027	-0.3614	-0.0268
13	LPC	-25.293	4.4674	-0.5135	0.1881	-5.2539	1.2917
14	LPS	-8.3696	-17.133	7.1137	-0.6220	-0.3300	-0.4086
15	MPC	-8.3696	17.133	7.1137	0.6220	-0.3300	0.4086
16	MPS	25.293	4.4674	0.5135	0.1881	5.2539	1.2917
17	AXC	-0.2479	-0.0245	-0.1960	-0.4717	-0.1868	0.0469
18	AXS	0.4619	0.5776	0.2208	-0.3162	0.3868	-0.0653
19	AYC	0.4619	-0.5776	0.2208	0.3162	0.3866	0.0653
20	AYS	0.2479	-0.0245	0.1960	-0.4717	0.1868	0.0469

	2	3	4	5	8	12
TC	-13.925	-135.11	-130.57	85.301	-27.246	68.710
TS	-43.710	-17.103	-42.641	-49.169	-65.659	-27.[illegible]34
UC	-5.3039	1.6133	-10.377	-1.4696	1.6531	0.0187
US	-2.9723	-1.6935	3.0498	-0.2738	2.0279	0.4194
TPC	-149.73	63.602	-30.970	-57.438	3.0571	-1.72[illegible]
TPS	84.337	-61.874	-40.009	13.073	14.887	-1.4621
UPC	-4.3585	1.8513	-0.9015	-1.6734	0.0490	-0.0513
UPS	2.4549	-1.6010	-1.1646	0.3411	0.4333	-0.0426
ATC	-0.4061	-1.5765	-0.8383	0.9994	-0.1672	0.4747
ATS	-0.5101	0.2831	-0.6601	-0.3185	-0.2453	0.0500

PRELIMINARY DATA

RUN;SEQ 1050
2.01150

		3	5	7	9	11	13
1	XC	50.178	-0.5757	13.371	23.593	6.5155	7.8316
2	XS	7.2920	20.695	32.534	70.370	19.075	25.904
3	YC	7.2920	-20.695	32.534	-70.370	19.075	-25.904
4	YS	-50.178	-0.5757	-13.371	23.593	-6.5155	7.8316
5	LC	0.0219	2.6719	-1.2907	1.7604	-1.1482	1.4914
6	LS	-3.6738	-0.2409	-3.4646	-3.1033	-1.2521	-0.7695
7	MC	-3.6738	0.2407	-3.4646	3.1033	-1.2521	0.7695
8	MS	-0.0219	2.6719	1.2907	1.7604	1.1482	1.4914
9	XPC	3.2832	1.4517	-0.5498	0.2521	0.3839	0.0951
10	XPS	2.1292	-2.0921	-1.6960	0.4157	0.4071	0.0442
11	YPC	2.1292	2.0921	-1.6969	-0.4157	0.4071	-0.0442
12	YPS	-3.2832	1.4517	0.5496	0.2521	-0.3839	0.0951
13	LPC	-15.708	-12.102	6.6746	1.3773	-2.5475	0.0167
14	LPS	10.632	-2.5067	0.5496	-1.9159	0.9407	-0.5086
15	MPC	10.632	2.5067	0.5395	1.9159	0.9407	0.5086
16	MPS	15.708	-12.102	-6.6746	1.3773	2.5475	0.0167
17	AXC	0.3911	0.0025	0.1186	0.1245	0.0621	0.0186
18	AXS	0.0651	0.1332	0.3256	0.5655	0.1616	0.1983
19	AYC	0.0651	-0.1332	0.3256	-0.5655	0.1616	-0.1983
20	AYS	-0.3911	0.0025	-0.1186	0.1245	-0.0621	0.0186

	2	3	4	5	8	12
TC	-13.882	9.8389	45.785	-22.198	6.1715	-18.462
TS	-31.837	-8.6411	63.418	43.165	47.534	-5.6961
QC	-2.9380	-2.7125	-0.1653	0.1381	1.7430	0.6710
QS	0.3700	-6.7884	4.4860	1.7078	1.6774	1.2913
TPC	-21.665	-7.3106	-38.812	11.165	5.8484	-1.9936
TPS	97.563	-62.738	-20.470	39.610	-17.014	0.5317
QPC	-0.6307	-0.2128	-1.1298	0.3250	0.1702	-0.0580
QPS	2.8399	-1.8262	-0.5958	1.1530	-0.4952	0.0155
ATC	-0.5357	0.3954	0.5784	-0.1684	0.0976	-0.1977
ATS	-0.3966	0.3905	0.7004	0.2465	0.4466	-0.0805

PRELIMINARY DATA

TST-727 PM-1 TN-12..2.01155 ID-PRESSUUTO 13 FEB 75005133 PAGE 33

RUNISEQ 1055
2.01155

	3	5	7	9	11	13
1 XC	-32.751	-32.652	31.450	-20.187	-2.6943	7.1970
2 XS	-11.469	-44.451	-9.1013	-3.7436	-22.375	5.4758
3 YC	-11.469	44.451	-9.1013	3.7435	-22.375	-5.4758
4 YS	32.751	-32.652	-31.450	-20.187	2.6943	7.1970
5 LC	-2.0069	1.6174	-1.0314	1.2262	-0.6532	-0.3037
6 LS	2.0524	1.3097	-0.4754	-0.3490	0.4969	0.6693
7 MC	2.0524	-1.3097	-0.4754	0.3490	0.4969	-0.6593
8 MS	2.0069	1.0174	1.0314	1.2262	0.6532	-0.3037
9 XPC	-6.7229	1.2615	-1.0018	-0.5742	-0.6404	-0.0624
10 XPS	-3.9453	2.1837	-0.9111	0.7451	-0.2148	-0.0547
11 YPC	-3.9373	-2.1867	-0.9111	-0.7451	-0.2183	0.0547
12 YPS	6.7229	1.2915	1.0018	-0.5742	0.6404	-0.0624
13 LPC	29.029	7.3004	7.1072	4.4189	2.1941	-0.0076
14 LPS	-19.415	-9.7452	-5.5002	1.1479	-2.4439	0.4718
15 MPC	-19.415	9.7452	-5.6002	-1.1479	-2.4439	-0.4718
16 MPS	-29.029	7.3604	-7.1072	4.4189	-2.1941	-0.0876
17 AXC	-0.1609	-0.1172	0.3032	-0.1099	-0.0669	0.0366
18 AXS	-0.2537	-0.3739	-0.0437	-0.0031	-0.1998	0.0184
19 AYC	-0.2537	0.3739	-0.0437	0.0031	-0.1998	-0.0184
20 AYS	0.1669	-0.1672	-0.3032	-0.1099	0.0669	0.0366

	2	3	4	5	8	12
TC	51.378	-11.689	-41.476	-89.383	-37.979	-18.623
TS	-13.739	17.781	90.692	-6.6416	15.740	51.060
OC	2.1516	-1.2623	-0.7464	-5.6411	-0.0240	0.3520
OS	-3.0540	3.9602	1.4516	0.4253	0.4307	-0.0193
TPC	-22.330	12.827	-1.2627	-40.275	22.596	-9.5702
TPS	-38.547	115.57	-37.633	-5.7769	14.621	-6.3801
OPC	-0.6500	0.3734	-0.0368	-1.1723	0.6577	-0.2786
OPS	-1.1220	3.3641	-1.0969	-0.1973	0.4256	-0.1857
ATC	0.5930	-0.1818	-0.2013	-0.2453	-0.2148	-0.0964
ATS	-0.2587	0.0525	1.3752	0.2062	0.0098	0.5650

PRELIMINARY DATA

ORIGINAL PAGE IS
OF POOR QUALITY

TST-72T PH-I TN-12..2.01:56 ID-PRESSOUTO 13 FEB 75@05:33 PAGE 34

RUN:SEQ 1056
2.01:56

		3	5	7	9	11	13
1	XC	-43.438	-17.794	41.139	9.4296	-4.6379	30.177
2	XS	50.900	64.030	25.112	22.576	17.531	24.405
3	YC	50.900	-64.030	25.112	-22.576	17.531	-24.405
4	YS	43.438	-17.794	-41.139	9.4296	4.6379	30.177
5	LC	0.7519	0.6618	1.9765	0.1307	-1.6895	-1.8666
6	LS	3.6057	-2.7089	-1.6533	-0.0518	0.5713	-0.2875
7	MC	3.6057	2.7089	-1.6533	0.0518	0.5713	0.2875
8	MS	-0.7519	0.6618	-1.9765	0.1307	1.6895	-1.8666
9	XPC	-0.6029	0.9286	-2.7834	0.0292	-0.5704	0.8330
10	XPS	5.0242	2.6134	1.5534	0.0612	0.7502	-0.3989
11	YPC	5.0242	-2.6134	1.5534	-0.0612	0.7502	0.3989
12	YPS	0.6029	0.9286	2.7834	0.0292	0.5704	0.8330
13	LPC	-21.299	9.9056	-1.6465	0.2180	-2.2659	-3.3645
14	LPS	-12.242	-9.1133	-15.382	-0.2466	-3.9733	-2.9617
15	MPC	-12.242	9.1133	-15.382	0.2466	-3.9733	2.9617
16	MPS	21.299	9.9056	1.6465	0.2180	2.2659	-3.3645
17	AXC	-0.3468	-0.2324	0.3164	0.0271	-0.0215	0.2527
18	AXS	0.2197	0.4518	0.2630	0.1640	0.0928	0.2070
19	AYC	0.2197	-0.4518	0.2630	-0.1640	0.0928	-0.2070
20	AYS	0.3468	-0.2324	-0.3164	0.0271	0.0215	0.2527

	2	3	4	5	8	12
TC	-21.149	-90.101	-17.882	119.91	44.164	38.765
TS	-78.452	-67.022	-51.770	105.77	48.551	-14.092
QC	-4.4157	0.0388	-10.670	3.6146	-0.1771	1.1301
QS	-4.4488	-0.0071	1.2076	0.7136	1.6969	-0.4056
TPC	-178.78	68.852	-27.315	-42.135	-19.539	6.1807
TPS	12.494	-44.129	-39.145	-15.266	23.925	-9.9025
QPC	-5.2039	2.0042	-0.7951	-1.2265	-0.5687	0.1795
QPS	0.3637	-1.2845	-1.1394	-0.4449	0.6964	-0.2862
ATC	-0.3978	-1.3532	0.1269	0.8676	0.2501	0.4625
ATS	-0.7443	-0.3868	-0.1074	0.9647	0.0986	-0.2599

PRELIMINARY DATA

TST-727 PH-1 TN-12..2.01:57 ID-PRESSUTTO 13 FEB 75 05:33 PAGE 35

RUN:SEQ 1057
2.01:57

		3	5	7	9	11	13
1	XC	40.423	13.022	-8.3356	-5.0020	26.501	-8.0734
2	XS	-3.9591	18.414	29.741	14.961	-11.956	36.365
3	YC	-3.9591	-18.414	29.741	-14.961	-11.956	-36.365
4	YS	-40.423	13.022	8.3356	-5.0020	-26.501	-8.0734
5	LC	4.1415	0.3403	-0.3745	0.7993	-0.7747	0.6567
6	LS	1.1424	0.1114	-0.9184	0.2401	-0.0278	-0.5972
7	MC	1.1424	-0.1114	-0.9134	-0.2401	-0.0278	0.5972
8	MS	-4.1415	0.3403	0.3745	0.7793	0.7747	0.6567
9	XPC	2.0920	2.6236	0.4922	-0.0362	0.1518	0.3472
10	XPS	3.2807	-0.6705	-1.1984	0.3763	-0.2610	0.1561
11	YPC	3.2807	0.6705	-1.1984	-0.3763	-0.2610	-0.1561
12	YPS	-2.0920	2.6236	-0.4922	-0.0362	-0.1618	0.3472
13	LPC	-18.627	-7.9605	4.4159	1.7492	0.8578	0.0373
14	LPS	3.1067	-10.442	4.4758	-0.5534	1.2187	-1.8472
15	MPC	3.1067	10.442	4.4758	0.5534	1.2187	1.8472
16	MPS	18.627	-7.9608	-4.4159	1.7492	-0.8578	0.0373
17	AXC	0.2320	0.1604	-0.1133	-0.0412	0.1961	-0.0507
18	AXS	-0.0145	0.1099	0.2699	0.1308	-0.1320	0.2610
19	AYC	-0.0145	-0.1099	0.2699	-0.1308	-0.1320	-0.2610
20	AYS	-0.2320	0.1604	0.1133	-0.0412	-0.1961	-0.0507

	2	3	4	5	8	12
TC	-9.3105	-17.809	-69.455	0.0017	25.564	-9.8553
TS	-37.151	58.154	85.070	-26.508	15.175	-32.499
QC	-2.1973	1.0460	-2.2403	-1.0798	-0.4565	0.0935
QS	0.2868	-1.9493	4.2938	1.9073	-0.3910	-0.2218
TPC	-68.453	19.406	-27.913	-18.609	1.3957	-6.0416
TPS	62.073	-59.814	-12.229	39.610	2.8576	-5.7820
QPC	-1.9926	0.5649	-0.8125	-0.5417	0.0406	-0.2341
QPS	1.8068	-1.7411	-0.3569	1.1530	0.0632	-0.1653
ATC	-0.1623	-0.2843	-0.2038	0.2026	0.1220	0.0049
ATS	-0.4869	1.1165	0.6943	-0.2709	0.2099	-0.3807

PRELIMINARY DATA

TST-727 PH-1 TN-12..2.01:372   ID-PRESSOUTO   13 FEB 75 05:33   PAGE 36

RUN:SEQ 1372
2.01:372

		3	5	7	9	11	13
1	XC	-7.2691	-11.725	10.319	14.516	12.287	-9.8755
2	XS	29.261	9.6646	28.965	5.5906	2.3610	1.2442
3	YC	29.261	-9.6646	28.965	-5.5906	2.3610	-1.2442
4	YS	7.2691	-11.725	-10.319	14.516	-12.287	-9.8755
5	LC	1.5127	-0.4645	3.6767	2.7676	-1.3811	1.4459
6	LS	1.4094	0.2637	-0.1513	0.5734	2.0940	0.2906
7	MC	1.4094	-0.2637	-0.1513	-0.5734	2.0940	-0.2906
8	MS	-1.5127	-0.4645	-3.6767	2.7676	1.3811	1.4459
9	XPC	-0.2391	1.0393	0.3222	-0.1162	-0.4278	0.0402
10	XPS	5.6783	1.0991	0.1910	0.3569	0.0470	0.0681
11	YPC	5.6783	-1.0991	0.1910	-0.3569	0.0470	-0.0681
12	YPS	0.2391	1.0393	-0.3222	-0.1162	0.4278	0.0402
13	LPC	-24.918	2.9330	-1.4553	1.8145	0.6031	0.2279
14	LPS	-11.847	-6.7303	1.0758	-0.1596	-1.9999	-0.3089
15	MPC	-11.847	6.7303	1.0758	0.1596	-1.9999	0.3089
16	MPS	24.918	2.9330	1.4553	1.8145	-0.6031	0.2279
17	AXC	-0.2436	-0.0310	0.0397	0.0346	0.1788	-0.1304
18	AXS	0.1691	0.0248	0.1553	0.1233	0.0033	0.0476
19	AYC	0.1691	-0.0248	0.1553	-0.1233	0.0033	-0.0476
20	AYS	0.2436	-0.0310	-0.0397	0.0346	-0.1788	-0.1304

	2	3	4	5	8	12
TC	25.458	5.9012	-27.151	-12.453	38.840	4.8337
TS	3.9675	-3.6773	19.647	22.231	-10.466	-6.6414
QC	-0.5001	0.0447	-1.0753	-1.5118	1.5158	-0.2230
QS	0.0660	0.0142	1.2611	1.5690	0.3169	0.4415
TPC	-97.496	73.238	11.099	-24.391	-12.361	-3.3230
TPS	8.4404	-55.427	-51.639	1.6615	3.8547	-9.4373
QPC	-2.8379	2.1318	0.3231	-0.7100	-0.3598	-0.0967
QPS	0.2457	-1.6134	-1.5031	0.0464	0.1122	-0.2747
ATC	0.1611	0.1367	0.0451	0.0012	0.2782	0.0317
ATS	-0.0049	0.1025	0.1525	0.2379	-0.1415	-0.0244

PRELIMINARY DATA

TST-727 PM-1 TN-12..2.01:373 ID-PRESSOUTO 13 FEB 75005:33 PAGE 37

RUN:SEQ 1373
2.01:373

		3	5	7	9	11	13
1	XC	-24.614	-4.5648	6.8084	16.971	14.412	0.1092
2	XS	2.2301	-0.5545	17.564	-4.1377	20.250	-7.9286
3	YC	2.2301	0.5545	17.564	4.1377	20.250	7.9286
4	YS	24.614	-4.5648	-6.8084	16.971	-14.412	0.1092
5	LC	3.0153	1.4385	2.0052	-1.5209	-0.4062	0.4378
6	LS	4.1590	0.1614	-1.8053	0.3603	0.4117	0.7772
7	MC	4.1590	-0.1614	-1.8053	-0.3603	0.4117	-0.7772
8	MS	-3.0163	1.4385	-2.0052	-1.5209	0.4062	0.4378
9	XPC	-6.7831	-0.5500	-0.4258	0.9406	-0.5065	-1.0749
10	XPS	1.4657	2.1322	1.3253	-1.8199	-0.2543	0.2412
11	YPC	1.4657	-2.1322	1.3253	1.8199	-0.2543	-0.2412
12	YPS	6.7831	-0.5500	0.4258	0.9406	0.5065	-1.0749
13	LPC	6.3505	10.567	-4.9995	-9.9150	2.2320	3.1201
14	LPS	-33.099	-1.5963	-4.6901	-0.7413	-1.7214	4.3416
15	MPC	-33.099	1.5963	-4.6901	0.7413	-1.7214	-4.3416
16	MPS	-6.3505	10.567	4.9995	-9.9150	-2.2320	3.1201
17	AXC	-0.3190	-0.0831	0.0767	0.1201	0.1591	-0.0172
18	AXS	-0.1599	0.0060	0.0895	-0.0942	0.1561	-0.0728
19	AYC	-0.1599	-0.0060	0.0895	0.0942	0.1561	0.0728
20	AYS	0.3190	-0.0831	-0.0767	0.1201	-0.1591	-0.0172

	2	3	4	5	8	12
TC	28.207	-12.980	-34.015	-21.222	22.526	2.5107
TS	29.267	-0.4812	-10.351	10.886	32.609	-0.9319
QC	-0.8904	-0.7128	-1.3713	-0.5909	0.2667	0.3653
QS	-1.0844	0.2027	-2.6507	0.3590	0.3300	-0.2477
TPC	-46.921	68.059	-2.0602	-20.935	-26.916	11.564
TPS	-40.275	69.583	-63.735	-28.777	22.796	17.412
QPC	-1.3658	2.5632	-0.0600	-0.6094	-0.7835	0.3366
QPS	-1.1723	2.0254	-1.3552	-0.5376	0.6635	0.5066
ATC	0.2526	-0.0622	-0.2196	-0.1745	0.1098	-0.0488
ATS	0.1940	0.1843	0.1220	0.1257	0.1830	-0.0073

PRELIMINARY DATA

TST-727 PH-1 TN-12..2.01:374 ID-PRESSUUTO 13 FEB 75a05:33 PAGE 38

RUN:SEQ 1374
2.01:374

		3	5	7	9	11	13
1	XC	-8.6983	-9.6701	-12.477	31.042	-35.843	4.5957
2	XS	8.4999	27.142	5.4089	35.964	12.940	-6.6546
3	YC	8.4999	-27.142	5.4089	-35.964	12.940	6.6546
4	YS	8.8983	-9.6701	12.477	31.042	35.843	4.5957
5	LC	0.7483	1.8970	0.1542	-1.1434	-1.1097	0.7668
6	LS	2.6663	-1.0504	0.5275	-5.5538	0.7453	-0.0473
7	MC	2.6624	1.0504	0.5275	5.5538	0.7453	0.0473
8	MS	-0.7483	1.8970	-0.1542	-1.1434	1.1097	0.7668
9	XPC	-2.9191	0.2211	-0.2741	0.7806	-0.1426	0.2331
10	XPS	-1.6762	1.1022	1.5221	-0.9473	-0.0856	0.1276
11	YPC	-1.6762	-1.1022	1.5221	0.9473	-0.0856	-0.1276
12	YPS	2.9191	0.2211	0.2741	0.7806	0.1426	0.2331
13	LPC	13.033	4.5017	-6.2761	-5.7139	0.6533	0.1266
14	LPS	-9.3497	-3.0820	-4.1170	-1.6656	-0.4742	-1.2835
15	MPC	-9.3497	3.0820	-4.1170	1.6656	-0.4742	1.2835
16	MPS	-13.033	4.5017	6.2761	-5.7139	-0.6533	0.1266
17	AXC	-0.0390	0.0370	-0.0747	0.3302	-0.2083	0.0407
18	AXS	-0.0936	0.1599	-0.0248	0.3336	0.1573	-0.1227
19	AYC	-0.0936	-0.1599	-0.0248	-0.3336	0.1573	0.1227
20	AYS	0.0390	0.0370	0.0747	0.3302	0.2083	0.0407

	2	3	4	5	8	12
TC	0.9933	-2.5714	-6.7333	-30.264	-0.7361	6.1366
TS	16.050	-15.963	9.3812	58.041	-3.8991	-9.9157
QC	-0.0402	0.3168	0.1217	0.3393	-1.7479	0.9429
QS	-0.2452	1.0737	2.3567	2.7651	-1.0656	-0.5011
TPC	15.286	9.1050	-24.324	-16.017	-10.102	6.5066
TPS	36.021	53.633	-33.629	-8.5733	-5.5826	13.292
QPC	0.4449	0.2650	-0.7080	-0.4662	-0.2940	0.2476
QPS	1.0485	1.5612	-0.9789	-0.2496	-0.1625	0.3865
ATC	-0.0464	-0.1062	0.0818	0.0537	0.0073	0.0293
ATS	0.0561	-0.0940	0.0065	0.2489	-0.0390	-0.0903

PRELIMINARY DATA

RUN:SEQ 1376
2.01:376

		3	5	7	9	11	13
1	XC	-22.811	21.553	-3.4691	18.579	13.614	-44.915
2	XS	2.7157	-13.349	-4.3312	-0.2105	-24.001	11.021
3	YC	2.7157	13.349	-4.3312	0.2105	-24.001	-11.021
4	YS	22.811	21.553	3.4691	18.579	-13.614	-44.915
5	LC	2.9322	-1.7780	0.0765	3.3217	-3.5566	5.0419
6	LS	5.8902	-5.8551	-0.7473	-2.5031	0.7424	-2.7196
7	MC	5.8902	5.8551	-0.7479	2.5031	0.7424	2.7196
8	MS	-2.9322	-1.7780	-0.0765	3.3217	3.5566	5.0419
9	XPC	-4.6622	-1.6583	-10.102	12.557	-11.482	0.5668
10	XPS	17.416	1.8151	-14.685	-12.760	-1.8975	0.8492
11	YPC	17.416	-1.8151	-14.685	12.760	-1.8975	-0.8492
12	YPS	4.6622	-1.6583	10.102	12.557	11.482	0.5668
13	LPC	-68.911	11.258	84.780	-80.851	30.297	2.7148
14	LPS	-53.921	3.9577	-17.200	-31.823	-47.669	-4.1449
15	MPC	-53.921	-3.9577	-17.200	31.823	-47.669	4.1449
16	MPS	68.911	11.258	-84.780	-80.851	-30.297	2.7148
17	AXC	-0.1943	0.1291	0.0017	0.1269	0.1935	-0.3579
18	AXS	-0.1599	-0.2185	0.0221	0.0675	-0.0868	0.1296
19	AYC	-0.1599	0.2185	0.0221	-0.0675	-0.0868	-0.1296
20	AYS	0.1943	0.1291	-0.0017	0.1269	-0.1935	-0.3579

	2	3	4	5	8	12
TC	-21.065	-47.591	-47.629	22.536	13.553	8.4299
TS	28.630	-14.914	28.429	-19.792	-13.594	2.7756
QC	-1.7100	-2.4714	-0.3999	1.4879	0.7077	-0.1977
QS	-0.9357	1.5952	4.3759	-2.6918	0.4045	0.6237
TPC	212.60	255.11	-36.812	-5.5626	-54.629	63.658
TPS	-48.449	-120.89	-8.9056	-39.344	262.71	58.045
QPC	6.1385	7.7166	-1.1295	-0.1625	-1.5960	1.8533
QPS	-1.4103	-3.5189	-0.2592	-1.1452	7.6472	1.6906
ATC	0.0159	-0.1879	-0.1550	-0.0171	0.1269	0.0244
ATS	0.3209	0.1537	0.4210	-0.4124	-0.1952	0.0195

PRELIMINARY DATA

TST-727 PH-1 TN-12..2.01:377 ID-PRESSOUTO 13 FEB 75 05:33 PAGE 40

RUN:SEQ 1377
2.01:377

		3	5	7	9	11	13
1	XC	25.864	7.2293	-12.135	-55.953	-56.570	2.2504
2	XS	-15.306	12.597	3.2268	24.279	-0.3876	-8.2842
3	YC	-15.306	-12.597	3.2268	-24.279	-0.3876	8.2842
4	YS	-25.864	7.2293	-12.185	-55.953	56.570	2.2504
5	LC	5.3666	1.1529	1.1818	1.9313	3.3085	-0.1550
6	LS	3.0821	-1.2083	-0.2227	-1.0386	0.0161	-0.1745
7	MC	3.0621	1.2083	-0.2227	1.0386	0.0161	0.1745
8	MS	-5.3666	1.1529	-1.1818	1.9313	-3.3085	-0.1550
9	XPC	-4.5077	2.5761	3.0916	-0.8351	-0.4130	-0.6095
10	XPS	5.6105	4.6767	-0.2334	-0.7932	-0.5270	0.4438
11	YPC	5.6105	-4.6767	-0.2334	0.7932	-0.5270	-0.4438
12	YPS	4.5077	2.5761	-3.0916	-0.8351	0.4130	-0.6095
13	LPC	-16.487	15.988	-4.8337	-1.9550	3.1381	3.1401
14	LPS	-30.794	-20.393	14.250	5.2367	-0.8426	1.8781
15	MPC	-30.794	20.393	14.250	-5.2367	-0.8426	-1.8781
16	MPS	16.487	15.563	4.8337	-1.9550	-3.1381	3.1401
17	AXC	0.0830	0.0505	-0.1229	-0.4445	-0.4616	0.0459
18	AXS	-0.1371	0.0413	0.0157	0.2122	0.0258	-0.0644
19	AYC	-0.1371	-0.0413	0.0157	-0.2122	0.0258	0.0644
20	AYS	-0.0830	0.0505	0.1229	-0.4445	0.4616	0.0459

	2	3	4	5	8	12
TC	13.113	-9.5531	-42.737	-2.5870	31.206	-7.1833
TS	16.511	-21.334	0.1113	-13.336	11.536	-11.001
QC	-3.2090	2.3090	-10.163	0.0092	0.6608	-0.2440
QS	-3.0087	-2.6756	-0.9367	-0.5326	1.7761	-0.6926
TPC	-103.08	116.30	-34.426	-84.802	-5.5162	-11.232
TPS	55.893	-1.4621	-25.388	-15.950	11.498	17.612
QPC	-3.0004	3.3854	-1.0021	-2.4684	-0.1606	-0.3265
QPS	1.6269	-0.0426	-0.7390	-0.4643	0.3347	0.5126
ATC	0.1232	0.0647	-0.1330	-0.0586	0.3099	-0.1574
ATS	0.2062	0.1379	0.2257	-0.0635	0.1537	-0.0642

PRELIMINARY DATA

RUN:SEQ 1378
2.01:378

		3	5	7	9	11	13
1	XC	-5.6555	-7.5073	1.5612	5.9509	8.4981	6.4613
2	XS	41.212	29.410	10.310	-15.670	18.515	3.2590
3	YC	41.212	-29.410	10.310	15.670	18.515	-3.2590
4	YS	5.6555	-7.5073	-1.5612	5.9509	-8.4981	6.4613
5	LC	4.6545	-0.2772	1.7635	0.9784	-0.0290	0.7927
6	LS	2.9413	0.3538	2.3702	1.3053	-0.8670	0.9285
7	MC	2.9413	-0.3538	2.3702	-1.3053	-0.8670	-0.9285
8	MS	-4.6545	-0.2772	-1.7635	0.9784	0.0290	0.7927
9	XFC	-2.1973	4.6884	-0.1189	-0.2826	0.2011	-0.6090
10	XFS	7.3979	2.6424	-1.9633	0.2065	-0.3991	-0.2281
11	YFC	7.3979	-2.6424	-1.9633	-0.2065	-0.3991	0.2281
12	YFS	2.1973	4.6884	0.1189	-0.2826	-0.2011	-0.6090
13	LFC	-28.660	2.8890	8.9936	1.4595	1.4001	0.1391
14	LFS	-23.873	-25.959	3.2005	0.6704	1.6567	3.1532
15	MFC	-23.873	25.959	3.2005	-0.6704	1.6567	-3.1532
16	MFS	28.660	2.8890	-8.9936	1.4595	-1.4001	0.1391
17	AXC	-0.4234	-0.0245	0.0510	0.1060	0.0731	0.0904
18	AXS	0.2250	0.1384	0.0004	-0.1019	0.1906	0.0595
19	AYC	0.2250	-0.1384	0.0004	0.1019	0.1906	-0.0595
20	AYS	0.4234	-0.0245	-0.0510	0.1060	-0.0731	0.0904

	2	3	4	5	8	12
TC	22.216	-5.9175	-33.519	-23.408	13.868	8.0617
TS	20.321	-18.748	14.693	-2.5865	-7.4601	6.6697
QC	-1.3416	2.7719	-7.6806	-2.6164	1.0786	-0.7023
QS	-0.7363	0.6141	0.8404	1.1161	-0.9669	-0.4661
TPC	-115.77	114.84	12.095	-61.147	-26.185	-3.5885
TPS	39.743	-48.648	-11.032	31.302	21.400	-8.6396
QPC	-3.3699	3.3428	0.3521	-2.3520	-0.7622	-0.1045
QPS	1.1560	-1.4161	-0.3211	0.9112	0.5229	-0.2515
ATC	0.1415	0.1147	0.0964	-0.1261	0.1037	0.1316
ATS	0.1074	0.0195	0.2379	0.0964	-0.0793	0.1611

PRELIMINARY DATA

ORIGINAL PAGE IS
OF POOR QUALITY

TST-727 PH-1 T.4-12..2.01:379   ID-PRESSUUTO   13 FEB 75005:33   PAGE 42

RUN:SEQ 1379
2.01:379

		3	5	7	9	11	13
1	XC	-42.057	-54.467	-8.3979	28.530	-6.7462	6.5748
2	YS	9.2395	30.185	-17.326	-63.272	0.9154	31.084
3	YC	9.2395	-30.185	-17.328	63.272	0.9154	-31.084
4	YS	42.057	-54.467	8.3979	28.530	6.7462	6.5748
5	LC	-2.1800	3.3179	-0.4444	-1.7146	-0.9676	0.3410
6	LS	1.4831	3.4445	-0.5175	5.4191	-1.7665	-1.2681
7	MC	1.4831	-3.4445	-0.5175	-5.4191	-1.7665	1.2681
8	MS	2.1800	3.3179	0.4444	-1.7146	0.9576	0.3410
9	XPC	-8.6429	2.5842	-2.6314	0.2658	-0.0428	0.5532
10	XPS	-5.9042	-0.9898	1.8240	-0.5762	-0.0193	-0.4667
11	YPC	-5.9042	0.9898	1.8240	0.5762	-0.0193	0.4667
12	YPS	8.6429	2.5842	2.6314	0.2658	0.0428	0.5532
13	LPC	42.793	-9.3318	-3.0489	-3.0783	0.1672	-3.1357
14	LPS	-27.374	-9.6500	-15.441	-0.0919	-0.1543	-1.5835
15	MPC	-27.374	9.6500	-15.441	0.0919	-0.1543	1.5835
16	MPS	-42.793	-9.3318	3.0489	-3.0783	-0.1672	-3.1357
17	AXC	-0.2595	-0.4037	-0.0559	0.2730	-0.0969	0.0223
18	AXS	-0.0812	0.2344	-0.1782	-0.5047	-0.0143	0.2339
19	AYC	-0.0812	-0.2344	-0.1782	0.5047	-0.0143	-0.2339
20	AYS	0.2695	-0.4037	0.0559	0.2736	0.0969	0.0223

	2	3	4	5	8	12
TC	1.4764	-4.2670	-25.824	-52.861	24.933	2.7931
TS	28.779	-13.951	1.5341	15.502	2.2553	6.6503
QC	0.4814	-0.6071	-2.2809	-5.0606	-1.1759	-0.9178
QS	-0.8498	2.9724	2.1308	5.0975	-0.7360	0.6776
TPC	8.5733	15.219	-2.3261	-14.222	-12.627	4.2534
TPS	-0.5981	168.48	-84.071	42.401	-12.893	4.7851
QPC	0.2495	0.4430	-0.0677	-0.4140	-0.3676	0.1235
QPS	-0.0174	4.9040	-2.4472	1.2342	-0.3753	0.1393
ATC	-0.0769	-0.0915	0.0927	-0.0403	0.1586	0.0012
ATS	0.1550	-0.1110	-0.0439	0.3619	-0.1293	0.0525

PRELIMINARY DATA

TST-727 PF-1 TN-12..2.01:381 ID-PRESSUUTO 13 FEB 75@05:33 PAGE 43

RUN:SEQ
2.01:381 /331

		3	5	7	9	11	13
1	XC	-27.746	30.290	-6.9674	-8.2807	-14.142	41.813
2	XS	11.215	32.111	-5.0208	6.8123	-10.542	-41.747
3	YC	11.215	-32.111	-5.0208	-6.8123	-10.542	41.747
4	YS	27.745	30.290	6.9874	-8.2807	14.142	41.813
5	LC	-1.4385	4.5900	1.6153	1.1601	1.2022	-0.8213
6	LS	1.1683	-5.5581	0.4993	-2.1986	0.4069	0.4503
7	MC	1.1668	5.5581	0.4993	2.1980	0.4069	-0.4503
8	MS	1.4355	4.6900	-1.6053	1.1601	-1.2022	-0.8213
9	XFC	-5.0759	-0.2885	-1.6372	1.1385	1.7703	-1.1255
10	XFS	1.1655	0.5097	0.6543	-0.4162	0.9104	-1.4466
11	YFC	1.1655	-0.5097	0.6543	0.4162	0.9104	1.4466
12	YFS	5.0759	-0.2885	1.6372	1.1385	-1.7703	-1.1285
13	LFC	4.4304	2.8243	0.1901	-4.0225	-7.4303	-4.3151
14	LFS	-24.684	0.3201	-8.5546	-4.2929	6.1752	7.7492
15	MFC	-24.684	-0.3201	-8.5546	4.2929	6.1752	-7.7492
16	MFS	-4.4304	2.8244	-0.1901	-4.0225	7.4303	-4.3151
17	AXC	-0.0523	0.2767	-0.0484	-0.0749	-0.1471	0.3481
18	AXS	-0.2660	0.1340	-0.0740	-0.0852	-0.0801	-0.3693
19	AYC	-0.2660	-0.1340	-0.0740	0.0852	-0.0801	0.3693
20	AYS	0.0528	0.2767	0.0484	-0.0749	0.1471	0.3481

	2	3	4	5	8	12
TC	-9.5803	2.9521	-10.963	42.130	1.6979	0.4156
TS	12.237	-40.609	-4.3709	39.328	24.165	-9.5208
OC	-0.3089	2.1192	-2.8032	4.3631	-1.1469	-0.1130
QS	-7.7270	-0.2383	-1.0516	5.0140	-1.1968	0.3395
TPC	-60.524	66.725	-47.452	-3.3094	-11.963	26.594
TPS	1.8609	51.307	-61.143	-8.6391	26.052	-14.069
UPC	-2.5768	1.9423	-1.3812	-0.0967	-0.3482	0.7736
CPS	0.0542	1.4935	-1.7796	-0.2573	0.7583	-0.4101
ATC	-0.2087	-0.1916	-0.1611	0.4525	0.1049	-0.0045
ATS	0.1696	-0.0769	-0.0512	-0.0940	0.0486	-0.1757

PRELIMINARY DATA

TST-727 PH-1 TN-12..2.011398 ID-PRESSUUTO 13 FEB 75405:33 PAGE 44

RUN:SEQ 1358
2.011398

		3	5	7	9	11	13
1	XC	-2.6327	7.1744	-2.3410	25.735	-0.3415	-36.355
2	XS	-14.582	1.3615	-10.768	-14.676	16.793	16.781
3	YC	-14.582	-1.3615	-10.768	14.676	16.793	-16.781
4	YS	2.6327	7.1744	2.3410	25.735	0.3415	-36.355
5	LC	0.0464	-0.4490	-0.1339	-2.7560	0.9256	1.9699
6	LS	2.4303	-0.2172	0.8522	-0.1354	0.6154	0.0424
7	MC	2.4303	0.2172	0.8522	0.1354	0.6154	-0.0424
8	MS	-0.0464	-0.4490	0.1339	-2.7560	-0.9256	1.9699
9	XPC	-3.8250	-1.2493	0.8797	1.0847	-0.0676	0.2293
10	XPS	2.8105	1.4455	-0.5150	-0.4039	-0.3382	0.0455
11	YPC	2.8105	-1.4455	-0.5150	0.4039	-0.3382	-0.0455
12	YPS	3.8250	-1.2493	-0.8797	1.0847	0.0676	0.2293
13	LPC	-5.2606	8.8294	1.9676	-3.8651	1.6388	-0.2329
14	LPS	-22.423	2.8314	5.4775	-4.0763	0.3408	-1.1105
15	MPC	-22.423	-2.8314	5.4775	4.0763	0.3408	1.1105
16	MPS	5.2606	8.8294	-1.9676	-3.8651	-1.6388	-0.2329
17	AXC	0.0277	0.0505	0.0139	0.2070	0.0119	-0.3345
18	AXS	-0.1605	-0.0518	-0.0708	-0.0718	0.1154	0.1191
19	AYC	-0.1605	0.0518	-0.0708	0.0718	0.1154	-0.1191
20	AYS	-0.0277	0.0505	-0.0139	0.2070	-0.0119	-0.3345

	2	3	4	5	8	12
TC	-1.8870	-3.3395	-21.351	-4.2064	-5.7937	-0.1055
TS	11.497	10.056	-1.2326	11.680	-20.646	4.3548
QC	-1.7231	-0.6810	-3.0444	-0.6939	-2.2334	-1.3691
QS	-1.5741	0.3593	-2.7182	0.3092	-0.8650	0.9609
TPC	-63.409	74.366	24.524	-5.1539	22.330	-0.8640
TPS	6.1807	18.808	-28.378	-30.439	-6.5130	8.0416
QPC	-1.8475	2.1647	0.7138	-0.1509	0.6500	-0.0251
QPS	0.1799	0.5475	-0.8260	-0.8560	-0.1896	0.2341
ATC	0.0207	-0.0574	0.3356	0.0232	-0.1550	0.0566
ATS	0.1306	0.0549	0.2233	0.0500	-0.0720	0.0781

PRELIMINARY DATA

TST-727 PH-1 TN-12--2.01:399 ID-PRESSUUTO 13 FEB 75*05:33 PAGE 45

RUN:SEQ 1399
2.01:399

		3	5	7	9	11	13
1	XC	10.043	-7.2833	-6.9771	-1.3089	19.292	-0.0432
2	XS	-0.6453	3.6072	13.443	21.990	-5.6954	1.0634
3	YC	-0.6453	-3.6072	13.453	-21.990	-5.6954	-1.0634
4	YS	-10.043	-7.2833	6.9771	-1.3089	-19.292	-0.0432
5	LC	0.5299	-0.0598	-0.1659	-0.3333	-0.4432	0.6928
6	LS	1.8097	-0.5337	-1.0337	-0.0158	1.1494	-0.9489
7	MC	1.8097	0.5337	-1.0337	0.0158	1.1494	0.9489
8	MS	-0.5299	-0.0598	0.1659	-0.3333	0.4432	0.6925
9	XPC	-1.2249	-2.4241	-1.5335	0.7122	-1.2880	0.0988
10	XPS	-5.6648	0.4794	0.4342	2.7970	1.6534	0.7340
11	YPC	-5.6648	-0.4794	0.4342	-2.7970	1.6534	-0.7340
12	YPS	1.2249	-2.4241	1.4395	0.7122	1.2880	0.0988
13	LPC	20.518	6.7481	1.5573	11.137	-5.8286	3.0900
14	LPS	5.6770	9.9139	-9.0398	-8.4968	-9.2745	-1.8361
15	MPC	5.6770	-9.9139	-9.0398	8.4968	-9.2745	1.8361
16	MPS	-20.518	6.7481	-1.5573	11.137	5.8286	3.0900
17	AXC	0.0824	-0.0376	-0.0668	-0.0640	0.1318	-0.0270
18	AXS	-0.1146	0.0035	0.1108	0.0554	-0.0844	0.0329
19	AYC	-0.1146	-0.0035	0.1108	-0.0954	-0.0844	-0.0329
20	AYS	-0.0824	-0.0376	0.0568	-0.0640	-0.1318	-0.0270

	2	3	4	5	8	12
IC	-13.612	-7.7311	-32.750	13.202	1.9264	0.2217
IS	-13.495	-8.3503	-30.797	20.745	7.1344	-4.4462
QC	0.9121	-0.9102	-2.5526	0.4028	1.1767	-0.5304
QS	-3.6282	-1.6029	-0.7158	3.4469	0.4370	0.1556
TPC	-150.80	-60.545	-0.2656	18.941	-55.427	14.2[illegible]
TPS	25.587	75.565	-105.54	-35.157	20.602	7.6429
QPC	-4.3894	-1.7623	-0.0077	0.5513	-1.6134	0.41[illegible]
QPS	0.7448	2.1996	-3.0720	-1.0234	0.5997	0.2225
ATC	-0.0415	0.0073	-0.0244	0.0281	-0.0012	0.0574
ATS	-0.0439	-0.0635	-0.0049	-0.1251	0.0256	-0.0012

PRELIMINARY DATA

TST-72T PH-1 TN-T2..2.01:400   TO-PRESSOUTO   13 FEB 75J05133   PAGE 46

RUN:SEQ 1400
2.01:400

		3	5	7	9	11	13
1	XC	9.0483	-41.030	-8.1876	-21.014	9.1955	10.703
2	XS	10.633	11.388	9.4482	19.364	-12.156	-20.997
3	YC	10.633	-11.388	9.4482	-19.364	-12.156	20.997
4	YS	-9.0483	-41.030	8.1876	-21.014	-9.1955	10.703
5	LC	2.0248	8.5553	1.2181	1.1770	-1.5872	-0.1931
6	LS	-1.1232	7.0421	0.7497	0.3148	0.1552	1.0146
7	MC	-1.1232	-7.0421	0.7497	-0.3148	0.1552	-1.0146
8	MS	2.0248	8.5553	-1.2181	1.1770	1.5872	-0.1931
9	XPC	9.1682	-11.239	-0.8530	0.6135	-0.7997	-1.9373
10	XPS	-10.90[illegible]	-5.8497	-2.1844	1.2743	-0.9630	-1.8458
11	YPC	-10.9[illegible]	5.8497	-2.1844	-1.2743	-0.9630	1.8458
12	YPS	-9.1682	-11.239	0.8530	0.6135	0.7997	-1.9373
13	LPC	31.2[illegible]	-4.7616	11.378	4.5247	5.8202	-4.5807
14	LPS	61.676	61.306	0.3431	-5.1015	-1.7406	12.159
15	MPC	61.676	-61.306	0.3431	5.1015	-1.7406	-12.159
16	MPS	-31.258	-4.7616	-11.378	4.5247	-5.8202	-4.5807
17	AXC	0.0844	-0.2015	-0.1093	-0.1811	0.1227	0.0754
18	AXS	0.1816	0.0366	0.0620	0.1666	-0.1030	-0.2000
19	AYC	0.1816	-0.0366	0.0620	-0.1666	-0.1030	0.2000
20	AYS	-0.0844	-0.2015	0.1093	-0.1811	-0.1227	0.0754

	2	3	4	5	8	12
TC	3.6556	-2.8993	-10.619	-9.8265	11.749	18.351
TS	25.340	1.0625	-6.4282	-25.962	2.7809	-4.4841
OC	0.2771	1.2323	-2.2013	-1.6686	1.0511	-0.4981
OS	1.3336	-0.8363	1.3866	-0.0902	-0.7435	1.2441
TPC	-84.869	-230.25	81.945	108.48	-9.1839	-36.019
TPS	-64.798	-2.1932	-58.950	-20.017	7.0447	-24.9[illegible]
UPC	-2.4704	-6.7031	2.3853	5.4863	-0.1509	-1.0717
UPS	-1.8862	-0.0633	-1.7159	-2.3292	0.2051	-0.7274
ATC	0.0927	0.0476	0.0378	-0.1159	-0.0122	0.11[illegible]4
ATS	0.1928	-0.0085	0.0305	0.1257	-0.0610	-0.011[illegible]

PRELIMINARY DATA

TST-727 PH-1 TN-12..2.01:401 ID-PRESSURE 13 FEB 75 5:33 PAGE 47

RUN:SEQ 1401
2.01:401

		3	5	7	9	11	13
1	XC	5.3596	7.7945	4.1244	-3.2137	12.421	4.5293
2	XS	5.6092	12.093	8.7838	-16.042	37.921	9.0811
3	YC	5.6092	-12.093	8.7838	16.042	37.921	-9.0811
4	YS	-5.3596	7.7945	-4.1244	-3.2137	-12.421	4.5293
5	LC	-0.5831	3.0425	1.0308	1.6077	-0.1286	0.7002
6	LS	0.6792	0.4090	0.6412	0.5480	-2.8862	-0.5565
7	MC	0.6792	-0.4090	0.6412	-0.5480	-2.8862	0.5565
8	MS	0.5831	3.0425	-1.0308	1.0077	0.1286	0.7002
9	XPC	-3.9517	-8.4218	-4.5369	2.4985	4.9731	-3.4267
10	XPS	-4.7551	4.8213	10.708	-2.2834	2.4631	1.0021
11	YPC	-4.7551	-4.8213	10.708	2.2834	2.4631	-1.0021
12	YPS	3.9517	-8.4218	4.5369	2.4985	-4.9731	-3.4267
13	LPC	28.745	37.537	-38.195	-14.945	-22.238	10.998
14	LPS	-4.6090	28.465	-49.512	-6.0172	16.766	13.398
15	MPC	-3.6090	-28.465	-49.512	6.0172	16.766	-13.398
16	MPS	-28.745	37.537	38.195	-14.946	22.238	10.988
17	AXC	0.0227	0.1209	0.0350	-0.0173	0.1150	0.0245
18	AXS	-0.0506	0.0432	0.0537	-0.0540	0.2870	0.1144
19	AYC	-0.0506	-0.0432	0.0537	0.0540	0.2870	-0.1144
20	AYS	-0.0227	0.1209	-0.0350	-0.0173	-0.1150	0.0245

	2	3	4	5	8	12
TC	8.4014	9.0154	-21.067	-0.3633	-11.853	1.8633
TS	-16.450	-10.677	-7.3605	24.377	14.422	5.9673
UC	3.5535	-0.1708	-1.7265	1.2625	0.8677	0.4513
US	-1.9760	-0.5707	-0.7243	2.5534	-0.1432	0.4556
TPC	-218.32	-18.675	-146.61	26.451	184.49	-61.741
TPS	263.25	98.161	-216.53	-154.59	-35.622	-112.76
UPC	-6.3549	-0.5436	-4.2676	0.7699	5.4283	-1.7972
UPS	7.6026	2.8573	-6.3027	-4.4997	-1.0369	-3.2629
ATC	-0.0574	-0.0964	-0.1440	0.2196	0.0500	0.1110
ATS	-0.1184	-0.0329	0.0659	-0.1611	0.1232	0.0012

PRELIMINARY DATA

TST-727 PH-1 TN-12..2.01:405 ID-PRESSOUTO 13 FEB 75 05:33 PAGE 48

RUN:SEQ 1405
2.01:405

		3	5	7	9	11	13
1	XC	9.6443	-21.703	1.8319	-12.537	17.552	-4.4597
2	XS	-10.638	-10.959	0.7938	4.3283	-1.2982	7.6189
3	YC	-10.638	10.959	0.7938	-4.3283	-1.2982	-7.6189
4	YS	-9.6443	-21.703	-1.8919	-12.537	-17.652	-4.4597
5	LC	-0.5425	1.2608	0.4099	-0.8605	-2.1534	-0.3234
6	LS	-0.3635	1.5306	-1.4097	1.6984	0.8329	0.7059
7	MC	-0.3635	-1.5306	-1.4097	-1.6984	0.8329	-0.7059
8	MS	0.5425	1.2608	-0.4099	-0.8605	2.1534	-0.3234
9	XPC	-5.4432	-4.1977	-5.2041	-1.5363	0.4121	1.2822
10	XPS	-11.112	3.0020	1.8975	1.4529	0.4569	-0.5134
11	YPC	-11.112	-3.0020	1.8975	-1.4529	0.4569	0.5134
12	YPS	5.4432	-4.1977	5.2041	-1.5363	-0.4121	1.2822
13	LPC	65.668	21.384	1.4179	9.4082	-2.8237	-4.7296
14	LPS	-16.535	13.040	-26.846	4.0929	0.9717	-4.7501
15	MPC	-16.535	-13.040	-26.846	-4.0929	0.9717	4.7501
16	MPS	-65.668	21.384	-1.4179	9.4082	2.8237	-4.7296
17	AXC	0.0280	-0.0826	0.0256	-0.1207	0.1017	-0.0299
18	AXS	-0.1662	-0.1241	-0.0516	-0.0290	-0.0523	0.0404
19	AYC	-0.1662	0.1241	-0.0516	0.0290	-0.0523	-0.0404
20	AYS	-0.0280	-0.0826	-0.0256	-0.1207	-0.1017	-0.0299

	2	3	4	5	8	12
TC	5.4745	13.902	-11.923	-21.443	-4.8639	-7.3771
TS	-2.5020	-2.4175	-11.222	25.296	4.3717	2.1168
QC	2.6187	-2.3055	-1.0948	-3.2722	-0.3463	-0.3806
QS	-1.6291	0.7822	-0.9227	-1.5022	0.3471	-0.2434
TPC	-42.268	-51.772	130.73	5.7155	-9.6367	-5.7155
TPS	44.661	219.52	-182.96	-83.207	3.5224	3.0571
QPC	-1.2304	-1.5070	3.8052	0.1664	-0.2805	-0.1654
QPS	1.3000	6.3897	-5.3257	-2.4220	0.1025	0.0590
ATC	0.0110	0.1013	-0.0098	0.1579	-0.1049	-0.0781
ATS	-0.0329	-0.0354	0.0903	-0.0757	0.0659	0.1367

PRELIMINARY DATA

TST-727 PH-1 TN-12..2.01:584 ID-PRESSUUTO 13 FEB 75005:33 PAGE 49

RUN:SEQ 1584
2.01:584

		3	5	7	9	11	13
1	XC	-3.0758	-15.133	5.1032	11.267	1.4570	-7.6401
2	XS	0.0429	2.9369	10.342	-0.4547	-4.8636	1.2104
3	YC	0.0429	-2.9369	10.892	0.4547	-4.8636	-1.2104
4	YS	3.0758	-15.133	-5.1032	11.267	-1.4570	-7.6401
5	LC	0.4757	0.5391	0.1119	-0.9324	-1.1892	-0.3778
6	LS	-1.3909	0.6725	-0.1959	-1.6030	0.9467	0.4633
7	MC	-1.3909	-0.6725	-0.1959	1.6030	0.9467	-0.4633
8	MS	-0.4757	0.5391	-0.1119	-0.9324	1.1892	-0.3778
9	XPC	3.3940	-0.0101	-2.6799	-0.0121	-0.4715	-0.2106
10	XPS	2.3606	-1.1695	-2.0439	-0.6029	0.4427	-0.3007
11	YPC	2.3606	1.1695	-2.0439	0.6029	0.4427	0.3007
12	YPS	-3.3940	-0.0101	2.6799	-0.0121	0.4715	-0.2106
13	LPC	-16.993	-5.2033	14.221	-2.6696	-1.0807	-0.9426
14	LPS	10.669	2.2678	-8.0826	1.1998	-2.9470	1.5120
15	MPC	10.669	-2.2678	-8.0826	-1.1998	-2.9470	-1.5120
16	MPS	16.993	-5.2033	-14.221	-2.6696	1.0807	-0.9426
17	AXC	-0.0372	-0.0747	-0.0066	0.0418	0.0457	-0.0917
18	AXS	0.0569	0.0440	0.0950	-0.0414	-0.0369	0.0225
19	AYC	0.0569	-0.0440	0.0950	0.0414	-0.0369	-0.0225
20	AYS	0.0372	-0.0747	0.0066	0.0418	-0.0457	-0.0917

	2	3	4	5	8	12
TC	7.8554	-1.2921	2.3465	12.695	-0.9088	-17.596
TS	6.0237	-54.360	40.294	15.857	30.677	6.613[illegible]
QC	-1.5863	1.1211	-0.3967	-2.6767	-0.1608	0.2523
QS	-1.0139	-4.0988	2.6995	3.0435	0.0437	-0.4422
TPC	-60.212	-5.4497	-35.154	14.668	14.073	-3.5224
TPS	92.246	-66.593	-15.153	11.896	-3.3494	2.857[illegible]
QPC	-1.7527	-0.1586	-1.0524	0.4275	0.4082	-0.1025
QPS	2.6851	-1.9384	-0.4411	0.3453	-0.0967	0.0832
ATC	-0.0744	-0.1794	0.2318	0.2643	0.1489	-0.0952
ATS	0.0793	0.0525	-0.1147	-0.0354	0.1440	0.1196

PRELIMINARY DATA

TST-727 PH-1 TN-12..2.01:585 1D-PRESSAUTO 13 FEB 75 05:33 PAGE 50

RUN:SEQ 1585
2.01:585

		3	5	7	9	11	13
1	XC	-17.416	-12.106	-4.6043	-2.2689	12.046	-4.7575
2	XS	-14.707	-1.0628	-0.3242	7.3153	8.2151	2.6444
3	YC	-14.707	1.0628	-0.3242	-7.3153	8.2151	-2.6444
4	YS	17.416	-12.106	4.6043	-2.2689	-12.046	-4.7575
5	LC	0.0022	-0.1996	-0.9675	1.0655	-1.9281	0.8819
6	LS	0.8341	1.9348	0.8714	0.0602	-1.2417	0.0683
7	NC	0.8341	-1.9348	0.8714	-0.0602	-1.2417	-0.0683
8	NS	-0.0022	-0.1995	0.9676	1.0655	1.9281	0.8819
9	XPC	-7.4001	1.7456	-1.6703	2.2416	1.0909	-0.1680
10	XPS	0.7534	1.6521	-1.5101	-0.5262	0.7713	-0.6822
11	YPC	0.7534	-1.6521	-1.5101	0.5262	0.7713	0.6822
12	YPS	7.4001	1.7456	1.6703	2.2416	-1.0909	-0.1680
13	LFC	10.700	4.0599	9.9184	-6.6102	-5.5179	-2.7272
14	LFS	-34.478	-10.935	-4.5887	-9.0102	3.4054	2.0470
15	MPC	-34.478	10.935	-4.5887	9.0102	3.4054	-2.0470
16	MFS	-10.700	4.0598	-9.9184	-6.6102	5.5179	-2.7272
17	AXC	-0.0865	-0.0473	-0.0318	-0.0279	0.1160	-0.0065
18	AXS	-0.1616	-0.0872	-0.0320	0.0732	0.1046	-0.0060
19	AYC	-0.1616	0.0872	-0.0320	-0.0732	0.1046	0.0060
20	AYS	0.0865	-0.0478	0.0318	-0.0279	-0.1160	-0.0065

	2	3	4	5	8	12
TC	29.669	26.726	1.8493	-35.638	2.8195	10.451
TS	-6.6512	-13.984	-10.684	63.801	34.667	-11.857
QC	3.9353	0.3003	0.0758	-4.1884	-0.2073	0.0888
QS	0.2556	0.9973	-0.8448	2.5723	1.0070	1.6002
TPC	-41.139	85.467	-12.694	-35.547	-10.235	-5.0505
TPS	-52.570	84.537	-25.384	4.7651	20.602	-10.102
QPC	-1.1975	2.4878	-0.3695	-1.1220	-0.2979	-0.1470
QPS	-1.5302	2.4607	-0.7660	0.1393	0.5997	-0.2948
ATC	0.0903	0.0256	-0.0073	0.1147	0.1391	-0.0927
ATS	-0.0244	-0.0964	0.0171	0.0757	0.1611	0.0000

PRELIMINARY DATA

TST-727 PH-1 TN-12..2.01:586 ID-PRESSOUTO 13 FEB 75005:33 PAGE 51

RUN:SEQ 1586
2.01:586

		3	5	7	9	11	13
1	XC	-8.4698	0.2810	-11.567	4.1126	-4.4437	-10.349
2	XS	-19.536	-11.564	3.0589	-5.6986	14.332	-9.4226
3	YC	-19.536	11.564	3.0589	5.6986	14.332	9.4226
4	YS	8.4698	0.2810	11.567	4.1126	4.4437	-10.349
5	LC	-0.0629	2.8322	0.8008	0.8464	1.7283	-0.5328
6	LS	0.3640	1.7054	0.7546	-0.6790	1.8727	1.1525
7	MC	0.3640	-1.7054	0.7546	0.6790	1.8727	-1.1525
8	MS	0.0629	2.8322	-0.8008	0.8464	-1.7283	-0.5329
9	XPC	-5.1803	-0.3982	1.8257	-0.8586	-1.7676	-0.0594
10	XPS	-6.9553	0.9198	0.6363	0.6652	-1.4891	-1.2034
11	YPC	-6.9553	-0.9198	0.6363	-0.6652	-1.4891	1.2034
12	YPS	5.1803	-0.3982	-1.8257	-0.8586	1.7676	-0.0594
13	LPC	40.910	4.8645	-6.3116	4.6024	10.009	-5.2612
14	LPS	-9.9116	0.0300	6.9436	2.5701	-5.0633	2.5526
15	MPC	-9.9116	-0.0300	6.9435	-2.5701	-5.0633	-2.5526
16	MPS	-40.910	4.8645	5.3116	4.6024	-10.009	-5.2512
17	AXC	-0.0057	0.0423	-0.1017	0.0378	-0.0576	-0.0692
18	AXS	-0.1566	-0.0626	0.0088	-0.0675	0.1064	-0.1177
19	AYC	-0.1566	0.0626	0.0088	0.0675	0.1064	0.1177
20	AYS	0.0057	0.0423	0.1017	0.0378	0.0576	-0.0692

	2	3	4	5	8	12
TC	9.0770	10.027	10.742	-37.693	-8.1946	-4.0473
TS	10.505	1.0193	10.619	-37.162	-20.113	0.9688
QC	1.3424	-0.5978	2.3838	-4.4063	-0.7180	-0.6267
QS	0.1515	1.3863	2.0000	-3.4091	1.1822	0.4776
TPC	-3.5888	-33.496	26.052	-7.3770	-17.280	-7.1776
TPS	-105.40	135.11	18.077	-14.422	-3.9876	15.419
QPC	-0.1045	-0.9750	0.7583	-0.2147	-0.5030	-0.2039
QPS	-3.0681	3.9619	0.5262	-0.4198	-0.1161	0.4455
ATC	-0.0061	0.0476	-0.0098	-0.1159	-0.1025	0.0512
ATS	0.0256	-0.1037	0.0146	0.0744	-0.1318	0.0659

PRELIMINARY DATA

RUN:SEW 1594
2.01:594

		3	5	7	9	11	13
1	XC	-3.1480	-3.3129	-3.9281	11.783	7.6320	-7.0850
2	XS	18.583	10.026	-5.5152	0.6634	7.9145	14.754
3	YC	18.583	-10.026	-5.5152	-0.6634	7.9145	-14.754
4	YS	3.1480	-3.3129	3.9281	11.783	-7.6320	-7.0850
5	LC	-0.2876	0.3155	-0.4102	-0.5716	0.4811	-0.4198
6	LS	-0.8810	-0.4488	0.0186	-0.3458	-1.1309	-0.4312
7	MC	-0.8810	0.4488	0.0186	0.3458	-1.1309	0.4312
8	MS	0.2876	0.3155	0.4102	-0.5716	-0.4811	-0.4198
9	XPC	-4.0986	-1.7092	-0.4577	1.4443	-0.6296	0.5113
10	XPS	2.1533	1.0039	-1.0401	1.3835	0.3177	-0.6986
11	YPC	2.1533	-1.0039	-1.0401	-1.3835	0.3177	0.6986
12	YPS	4.0986	-1.7092	0.4577	1.4443	0.6296	0.5113
13	LPC	-1.8256	7.7318	6.4534	3.4333	-0.2220	-4.0916
14	LPS	-22.396	5.7246	-1.7773	-9.0792	-3.4155	-0.9555
15	MPC	-22.396	-5.7246	-1.7773	9.0792	-3.4155	0.9555
16	MPS	1.8256	7.7318	-6.4534	3.4333	0.2220	-4.0916
17	AXC	-0.0335	-0.0234	0.0104	0.0693	0.0481	-0.0260
18	AXS	0.0845	0.0684	-0.0444	-0.0140	0.1064	0.1336
19	AYC	0.0845	-0.0684	-0.0444	0.0140	0.1064	-0.1336
20	AYS	0.0335	-0.0234	-0.0104	0.0693	-0.0481	-0.0260

	2	3	4	5	8	12
TC	-2.8974	2.7407	-12.440	-12.672	-6.0931	3.9322
TS	-1.1612	0.3085	-39.647	-0.0862	6.1104	-3.8989
QC	-0.2423	-0.9651	-1.3440	-1.6699	0.6689	0.3295
QS	-1.3154	0.8151	-3.2625	0.3598	1.0390	0.4948
TPC	-83.207	58.985	11.165	5.0519	-7.7758	-1.4621
TPS	-59.947	28.976	-30.837	-31.635	0.4652	-2.3925
QPC	-2.4220	2.0080	0.3250	0.1470	-0.2263	-0.0426
QPS	-1.7449	0.8435	-0.6976	-0.0208	0.0135	-0.0698
ATC	-0.0342	-0.0342	-0.0232	-0.0525	-0.0671	0.0976
ATS	0.0342	0.0342	-0.0305	-0.0647	0.0305	0.0024

PRELIMINARY DATA

TSI-727 PH-1 TN-12..2.01:595 ID-PRESSUOTO 13 FEB 75?05:33 PAGE 53

RUN:SEQ 1595
2.01:595

		3	5	7	9	11	13
1	XC	-10.802	14.207	5.9510	-2.2333	-4.5938	-15.030
2	XS	2.4958	-0.6707	3.6003	-5.2394	-0.3225	6.8359
3	YC	2.4958	0.6707	3.6003	6.2494	-0.3225	-6.8359
4	YS	10.802	14.207	-5.9510	-2.2333	4.5938	-15.030
6	LC	0.1532	-0.5412	0.7970	-0.1555	-0.3302	1.0728
6	LS	2.1570	-1.3300	-0.6171	1.7356	-0.2127	-0.5195
7	NC	2.1570	1.3300	-0.0171	-1.7656	-0.2127	0.5195
8	NS	-0.1532	-0.5412	-0.7770	-0.1555	0.3302	1.0728
9	XPC	-4.9374	0.1810	-0.6708	0.9088	-1.5958	-0.2156
10	XPS	5.6947	0.6075	-0.5356	0.3913	-0.0584	0.8439
11	YPC	5.6947	-0.6075	-0.5956	-0.3913	-0.0684	-0.8439
12	YPS	4.9374	0.1810	0.6708	0.9088	1.5758	-0.2156
13	LPC	-16.064	2.3689	3.9348	0.0202	3.3333	4.1786
14	LPS	-32.680	-1.9632	-1.8536	-4.8022	-6.9961	-0.6411
16	NPC	-32.680	1.9632	-1.8536	4.8022	-6.9961	0.6411
16	NPS	16.094	2.3689	-3.9348	0.0202	-3.3333	4.1786
17	AXC	-0.0736	0.1298	0.0256	-0.0600	-0.0360	-0.1042
18	AXS	-0.0218	-0.0479	-0.0116	-0.1097	0.0510	0.0460
19	AYC	-0.0218	0.0479	-0.0116	0.1097	0.0510	-0.0460
20	AYS	0.0736	0.1298	-0.0256	-0.0600	0.0360	-0.1042

	2	3	4	5	8	12
TC	-6.9955	0.0373	-32.659	9.8482	-7.7860	4.8554
TS	-5.7809	-18.191	-25.538	-9.4916	6.7437	-8.9181
QC	-0.7095	-0.0539	-3.5611	1.3912	-0.1150	-0.1086
QS	-2.3638	0.3333	-2.8160	0.6155	-0.0541	-0.3293
TPC	-101.75	121.82	-11.298	-9.4373	-11.365	-6.1807
TPS	-38.879	2.9907	-10.699	-3.9676	6.3137	20.602
QPC	-2.9518	3.5460	-0.3289	-0.2747	-0.3306	-0.1799
QPS	-1.1317	0.0871	-0.3173	-0.1151	0.1636	0.6055
ATC	-0.0952	-0.1110	-0.0317	-0.0476	-0.0354	-0.0305
ATS	0.0415	0.0403	0.1245	-0.1989	0.0305	-0.0726

PRELIMINARY-DATA

ORIGINAL PAGE IS
OF POOR QUALITY

TST-727 PH-1 TN-12..2.01:596 ID-PRESSUUTO 13 FEB 75N05:33 PAGE 54

RUN:SEQ *1596*
2.01:596

		3	5	7	9	11	13
1	XC	-5.8983	-13.104	-24.034	-6.9275	-0.9671	-10.973
2	XS	-17.002	3.7092	21.437	-17.611	-0.5846	-0.3326
3	YC	-17.002	-3.7092	21.497	17.611	-0.5846	0.3326
4	YS	5.8983	-13.104	24.034	-0.9275	0.9671	-10.973
5	LC	-1.6138	4.1338	0.9414	1.2492	-1.2037	-0.3948
6	LS	-0.3761	0.3595	0.4867	0.6506	0.6033	-0.4942
7	NC	-0.3761	-0.3595	0.4867	-0.6508	0.6033	0.4942
8	NS	1.6138	4.1338	-0.9414	1.2492	1.2037	-0.3948
9	XFC	-7.1123	-1.4952	1.5852	2.1502	-0.3584	-1.4217
10	XPS	-5.4206	1.4510	-0.4444	1.1078	-0.9126	-1.0717
11	YPC	-5.4206	-1.4510	-0.4444	-1.1078	-0.9126	1.0717
12	YPS	7.1123	-1.4952	-1.5852	2.1602	0.3584	-1.4217
13	LPC	37.725	9.3217	-1.5985	0.8410	5.8971	-2.0836
14	LFS	-21.458	3.9190	9.2535	-11.752	-2.5453	6.3658
15	NPC	-21.458	-3.9190	9.2535	11.752	-2.5453	-6.3658
16	NPS	-37.725	9.3217	1.5985	0.8410	-5.8971	-2.0836
17	AXC	-0.0140	-0.0493	-0.2204	-0.0545	0.0209	-0.0790
18	AXS	-0.0980	0.0221	0.1289	-0.1345	-0.0158	-0.0392
19	AYC	-0.0980	-0.0221	0.1289	0.1345	-0.0158	0.0392
20	AYS	0.0140	-0.0493	0.2204	-0.0545	-0.0209	-0.0790

	2	3	4	5	8	12
TC	16.288	19.542	11.113	-44.312	-10.793	2.2239
TS	9.0417	-14.305	10.716	-11.146	-15.871	2.4665
QC	3.0961	0.2719	1.6185	-5.0877	-0.0854	0.2135
QS	0.7137	-1.4369	2.8245	-0.2874	0.7687	0.4715
TPC	2.9242	5.5162	38.214	-2.7248	-27.049	-7.3770
TPS	-117.37	144.42	-1.5286	-33.562	4.0540	2.7245
QPC	0.0851	0.1606	1.1123	-0.0793	-0.7874	-0.2147
QPS	-3.4164	4.2037	-0.0445	-0.9769	0.1180	0.0793
ATC	-0.0061	-0.0207	-0.0317	0.0110	-0.0940	-0.0037
ATS	0.0574	-0.1550	-0.1415	0.3063	-0.0378	-0.0574

PRELIMINARY DATA

TST-727 PH-1 TN-12..2.01:627 ID-PRESSOUTO 13 FEB 75-05:33 PAGE 55

RUN:SEQ 1627
2.01:627

	3	5	7	9	11	13
1 XC	14.955	-19.540	-30.607	-29.096	32.259	-18.679
2 XS	-8.6220	6.1771	11.267	59.560	-6.3782	33.521
3 YC	-8.6220	-6.1771	11.267	-59.560	-6.3782	-33.521
4 YS	-14.955	-19.540	30.607	-29.096	-32.259	-18.679
5 LC	9.8924	-0.9331	1.6463	1.0455	-1.8509	-0.9244
6 LS	-9.0589	0.7530	-0.3651	0.8711	-0.1485	-0.5956
7 MC	-9.0589	-0.7530	-0.3651	-0.8711	-0.1485	0.5956
8 MS	-9.8924	-0.9331	-1.6453	1.0455	1.8509	-0.9244
9 XPC	-1.9157	3.5693	1.9667	0.2268	-0.2524	0.3657
10 XPS	1.9459	-0.8696	-0.5691	-0.4748	0.3515	0.9350
11 YPC	1.9459	0.8696	-0.5691	0.4748	0.3515	-0.9350
12 YPS	1.9157	3.5693	-1.9657	0.2268	0.2524	0.3657
13 LPC	-5.0621	-10.705	-1.1965	-2.5513	-1.0898	3.4801
14 LPS	-12.259	-14.375	9.8644	-0.1106	-1.7954	-3.4101
15 MPC	-12.259	14.375	9.8644	0.1106	-1.7954	3.4101
16 MPS	5.0621	-10.705	1.1965	-2.5513	1.0898	3.4801
17 AXC	-0.3275	-0.1259	-0.2367	-0.2035	0.2547	-0.1329
18 AXS	-0.0536	0.0916	0.1945	0.5076	-0.0651	0.2950
19 AYC	-0.0536	-0.0916	0.1945	-0.5076	-0.0651	-0.2950
20 AYS	0.3275	-0.1269	0.2367	-0.2035	-0.2347	-0.1329

	2	3	4	5	8	12
TC	-5.3906	-21.438	-36.128	-3.2167	-3.2000	-0.4192
TS	-18.596	-19.521	-15.520	-33.712	1.3999	-9.6241
QC	-2.8198	3.3003	5.8449	-3.1819	-0.1665	0.8055
QS	-0.6255	2.8027	6.8648	-2.1764	-1.8543	-0.0247
TPC	-133.92	43.996	-12.029	-20.052	12.494	1.3957
TPS	47.052	3.8547	-20.935	53.699	5.8484	-13.624
QPC	-3.8981	1.2807	-0.3501	-0.7583	0.3637	0.0405
QPS	1.3870	0.1122	-0.6094	1.5631	0.1702	-0.3955
ATC	0.0342	-0.0659	-0.0464	-0.1074	-0.0940	-0.0574
ATS	-0.0635	-0.0171	0.0537	-0.3612	-0.0818	-0.0598

PRELIMINARY DATA

ORIGINAL PAGE IS
OF POOR QUALITY

TST-727 PH-1 TI-12..2.01:628 ID=PRESSDUTO 13 FEB 75d05:33 PAGE 56

RUN:SEQ 1628
2.01:628

		3	5	7	9	11	13
1	XC	-17.434	41.758	-1.6240	-19.116	-78.115	15.157
2	XS	-33.068	17.882	-11.663	-31.489	72.347	-16.673
3	YC	-33.008	-17.882	-11.663	31.489	72.347	16.673
4	YS	17.434	41.758	1.6240	-19.116	78.115	15.157
5	LC	1.2563	-5.0693	0.5467	-0.4230	6.5952	-0.5414
6	LS	0.2437	-4.3006	0.7533	-0.8224	-1.5056	-0.0087
7	MC	0.2437	4.3006	0.7533	0.8224	-1.5056	0.0087
8	MS	-1.2563	-5.0693	-0.5467	-0.4230	-6.5952	-0.5414
9	XPC	2.1882	-3.5135	-2.8407	-1.0316	0.5617	0.2394
10	XPS	1.3655	0.0624	1.8685	-1.0575	-0.7201	-0.6664
11	YPC	1.3600	-0.0624	1.8685	1.0575	-0.7201	0.6664
12	YPS	-2.1882	-3.5135	2.8407	-1.0316	-0.5617	0.2394
13	LPC	-10.263	7.0457	-2.9451	-2.7617	2.1433	-3.4308
14	LPS	7.1738	15.533	-16.237	6.6168	3.8769	0.1973
15	MPC	7.1738	-15.533	-16.237	-6.6168	3.8769	-0.1973
16	MPS	10.263	7.0457	2.9451	-2.7617	-2.1483	-3.4308
17	AXC	-0.1271	0.3631	0.0229	-0.1346	-0.7250	0.1263
18	AXS	-0.3312	0.2052	-0.0875	-0.2270	0.7597	-0.1113
19	AYC	-0.3312	-0.2052	-0.0875	0.2270	0.7597	0.1113
20	AYS	0.1271	0.3631	-0.0229	-0.1346	0.7250	0.1263

	2	3	4	5	8	12
TC	-94.397	35.365	-4.9255	75.270	-23.472	37.39[illegible]
TS	-24.655	7.9014	-25.295	42.761	-13.354	-7.9127
QC	2.3100	-0.7489	-0.0065	6.2285	1.4130	[illegible]
QS	-0.2767	-0.4116	-2.0412	9.3667	-0.2535	-1.7131
TPC	-64.865	-5.4497	28.445	35.091	-21.201	[illegible]
TPS	126.54	-41.338	24.856	-44.661	-18.409	6.9783
QPC	-1.8881	-0.1586	0.8280	1.0214	-0.6171	[illegible]
QPS	3.6833	-1.2033	0.7235	-1.3000	-0.5359	0.2031
ATC	-0.5906	0.1660	-0.1159	0.7931	-0.2026	0.1391
ATS	-0.0683	-0.0073	-0.3331	-0.1196	0.0512	-0.1045

PRELIMINARY DATA

TST-727 PM-1 TN-12..2.01:629 ID-PRESSUUTO 13 FEB 75N05:33 PAGE 57

RUN:SEQ 1629
2.01:629

	3	5	7	9	11	13
1 XC	18.226	-44.310	-55.414	27.604	-7.6811	-32.440
2 XS	-12.717	11.600	-40.763	-10.676	35.144	13.487
3 YC	-12.717	-11.609	-40.763	10.676	35.144	-13.487
4 YS	-18.226	-44.310	55.414	27.604	7.6811	-32.440
5 LC	2.4538	-1.4156	1.9653	-2.5773	-0.4358	0.0976
6 LS	3.4633	5.9073	3.9973	3.4846	-0.8360	-0.2734
7 MC	3.4633	-5.9074	3.9973	-3.4846	-0.8360	0.2734
8 MS	-2.4538	-1.4156	-1.9653	-2.5773	0.4358	0.0976
9 XLC	2.1530	9.5030	4.3405	1.4285	-4.5857	-5.9262
10 XLS	10.952	-14.352	4.5970	14.896	-7.3349	-4.2281
11 YLC	10.952	14.352	4.5970	-14.896	-7.3349	4.2281
12 YLS	-2.1530	9.5030	-4.3405	1.4285	4.5857	-5.9262
13 LPC	-52.999	-82.151	-26.854	63.804	41.471	-7.6173
14 LPS	-11.212	-15.160	10.925	-34.691	-6.5370	34.500
15 MPC	-11.212	15.160	10.925	34.691	-6.5370	-34.500
16 MPS	52.939	-82.151	26.854	63.804	-41.471	-7.6173
17 AXC	0.0774	-0.1913	-0.5754	0.1776	-0.1051	-0.3385
18 AXS	-0.2135	0.1622	-0.3554	-0.0379	0.2625	0.0799
19 AYC	-0.2135	-0.1622	-0.3554	0.0379	0.2625	-0.0799
20 AYS	-0.0774	-0.1913	0.5754	0.1776	0.1051	-0.3385

	2	3	4	5	8	12
TC	-21.611	29.867	-20.731	-22.363	41.295	9.6490
TS	-4.1717	238.53	62.942	74.643	38.465	-131.37
QC	-2.4661	-3.4644	-4.1475	-5.5966	0.6790	-0.7221
QS	0.1558	-1.4788	0.8763	-0.7576	0.8665	-1.1640
TPC	-156.25	114.44	-72.109	81.240	71.245	73.104
TPS	-0.9969	-139.43	120.62	266.04	-143.95	66.132
QPC	-4.5481	3.3312	-2.0990	2.3659	2.0738	2.1280
QPS	-0.0290	-4.0586	3.5112	7.7439	-4.1902	2.5071
ATC	0.0439	0.4612	0.1952	0.0427	0.3453	-0.1552
ATS	-0.1904	1.3715	0.5857	0.5332	-0.1086	-0.7273

PRELIMINARY DATA

ADVISED 2.011632 1632

		3	5	7	9	11	13
1	XC	2.9638	43.249	-45.355	69.529	-43.373	35.854
2	XS	-17.955	12.028	29.378	-29.233	0.7374	12.173
3	YC	-17.908	-12.028	29.378	29.233	0.7374	-12.173
4	YS	-2.9638	43.249	45.355	69.529	43.373	35.854
5	LC	1.2471	-2.5488	0.6090	-3.5973	2.6315	-1.4533
6	LS	-1.3599	-4.4342	-1.4424	-1.7355	-1.1578	0.7033
7	MC	-1.3599	4.4342	-1.4424	1.7455	-1.1578	-0.7033
8	MS	-1.2471	-2.5488	-0.6090	-3.5973	-2.6315	-1.4533
9	XPC	-7.5699	2.5408	-1.0784	0.5051	-0.6148	-0.4556
10	XPS	-3.6518	-0.3421	-0.2175	-0.8161	-0.5601	-0.3652
11	YPC	-3.6518	0.3421	-0.2175	0.8161	-0.5601	0.3652
12	YPS	7.5699	2.5408	1.0784	0.5051	0.6148	-0.4556
13	LPC	31.546	-8.5695	3.0210	-4.6042	3.6698	-0.7649
14	LPS	-20.479	-9.7454	-4.4025	-0.7045	-1.6610	2.7287
15	MPC	-20.479	9.7454	-4.4025	0.7045	-1.6610	-2.7287
16	MPS	-31.546	-8.5695	-3.0210	-4.6042	-3.6698	-0.7649
17	AXC	-0.0068	0.4654	-0.2740	0.6354	-0.3704	0.2486
18	AXS	-0.1724	0.1127	0.2402	-0.2238	0.1453	0.1519
19	AYC	-0.1724	-0.1127	0.2402	0.2238	0.1453	-0.1519
20	AYS	0.0068	0.4654	0.2740	0.6354	0.3704	0.2486

	2	3	4	5	8	12
TC	1.7391	-3.3305	3.3449	-43.889	21.071	-0.4095
TS	24.337	0.9637	1.9155	27.301	9.7536	-4.[illegible]324
QC	-0.7135	-0.2654	3.2306	8.1285	1.1519	0.4475
QS	1.3325	0.8923	1.9168	4.0852	-0.3051	-0.5759
TPC	-31.967	29.774	-30.173	-15.616	-2.3925	0.1373
TPS	-21.998	133.98	72.973	40.341	1.1503	12.[illegible]93
QPC	-0.9305	0.8667	-0.8783	-0.4546	-0.0655	0.[illegible]3[illegible]
QPS	-0.6403	3.9000	2.1241	1.1743	0.0346	0.3753
ATC	0.0610	0.0537	0.0061	0.0122	0.0659	0.0761
ATS	0.1220	-0.0879	-0.1257	0.0757	0.0073	-0.1466

LIMINARY DATA

TST-727 PH-1 TJ-12..2.01:634   1I-PRESSUUTO   13 FEB 75.05133   PAGE 59

POSTSEQ 2.01:633   1633

		3	5	7	9	11	13
1	XC	26.174	23.282	-34.492	-9.3462	16.352	3.9724
2	XS	-40.074	-31.702	7.4677	13.620	-14.676	1.6725
3	YC	-40.074	31.702	7.4677	-13.520	-14.676	-1.6725
4	YS	-26.174	23.282	34.492	-9.3462	-16.352	3.9724
5	LC	-1.7852	-4.5012	4.5529	-0.3494	-1.3769	-0.4736
6	LS	2.0186	-0.4510	0.0763	-1.0642	-0.9700	-0.6070
7	MC	2.0143	0.4710	0.0769	1.0662	-0.9700	0.6070
8	MS	1.7652	-4.5012	-4.5529	-0.3494	1.3769	-0.4736
9	XPC	-1.0005	2.4452	0.6037	-0.8235	0.3792	-0.9718
10	XPS	1.2590	-5.4318	-0.8141	2.3529	0.4192	0.2528
11	YPC	1.2590	5.4313	-0.8141	-2.3529	0.4192	-0.2628
12	YPS	1.0005	2.4452	-0.6037	-0.8235	-0.3792	-0.9718
13	LPC	-3.7205	-26.994	2.0957	12.117	-2.5928	3.0207
14	LPS	-6.4610	-0.5964	5.1931	-0.8138	0.4967	3.8402
15	MPC	-6.4610	0.5954	5.1631	0.8138	0.5967	-3.8402
16	MPS	3.7205	-26.904	-2.0967	12.117	2.5928	3.0207
17	AXC	0.2038	0.1473	-0.2597	-0.0875	0.1592	0.0023
18	AXS	-0.3771	-0.2366	0.0670	0.1448	-0.1384	0.0190
19	AYC	-0.3771	0.2366	0.0670	-0.1448	-0.1384	-0.0190
20	AYS	-0.2038	0.1473	0.2597	-0.0876	-0.1592	0.0023

		2	3	4	5	8	12
1	TC	43.070	9.4979	85.257	57.681	-33.002	-5.8995
2	TS	137.33	55.558	-51.959	-24.656	-2.1545	13.444
3	QC	1.5341	-1.3763	8.1655	3.2925	-0.2553	0.3516
4	QS	-1.2415	-0.1847	1.9356	0.5733	0.2050	-0.3756
5	TPC	100.02	25.986	6.9763	42.001	2.3261	2.1432
6	TPS	12.494	-0.4552	-67.965	86.331	11.365	-4.3154
7	QPC	2.9289	0.7564	0.2031	1.2400	0.0677	0.1656
8	QPS	0.3637	-0.0135	-1.9790	2.5129	0.3306	-0.1257
9	ATC	0.4466	0.1098	0.5235	-0.0427	-0.4100	-0.0073
10	ATS	0.9445	0.3002	-0.8456	-0.4405	0.1440	0.0293

PRELIMINARY DATA

X Long force
Y Lat force
T Vert force
L Roll Moment
M Pitch Moment
Q Torque

P Pitch Link Correction
A Hub acceleration correction

Long force = X + XP + AX
Lat force = Y + YP + AY
Vert force = T + TP + AT
Pitch Moment = M + MP
Roll Moment = L + LP
Torque = Q + QP

APPENDIX C - NASA AMES FIXED SYSTEM HUB LOADS DATA SUMMARY

A summary of the 4/rev content of the six vibratory hub loads are presented in Tables C-1 and C-2. Included in the summary is a definition of the test conditions as well as the sine, cosine and net vibratory load.

CORR	RUN	RPM	α_s	C_T	θ_{2p}	μ	T4C	T4S	T4	∠T4	MX4C	MX4S	MX4	∠MX4	MY4C	MY4S	MY4	∠MY4
1003	88	1670	5.0°	.0048	0.0	.296	-24.30	-33.28	41.21	216.	4.19	-19.39	19.88	167.	-13.44	-5.91	14.72	246.
1005	88	1673	5.0°	.0065	0.0	.295	1.59	.237	1.61	81.	-.930	-5.57	5.65	189.	-11.84	11.07	16.21	-47.
1006	88	1670	5.0°	.0110	0.0	.295	-34.55	-34.09	48.47	225.	-1.08	2.02	2.29	-28.	-5.28	6.00	7.99	-41.
1007	88	1670	5.0°	.0130	0.0	.298	10.72	-82.08	82.77	172.	-11.22	-6.52	12.98	239.	-9.95	7.17	12.26	-54.
1009	89	1633	5.0°	.0052	0.0	.497	6.81	10.06	12.15	34.	-2.27	-9.19	9.47	194.	-17.81	-5.43	18.64	253.
1010	89	1633	5.0°	.0057	0.0	.498	55.75	20.27	59.30	70.	-6.42	-7.99	10.25	219.	-7.66	-.03	7.66	269.
1011	89	1633	5.0°	.0085	0.0	.498	-25.31	-23.80	34.74	133.	-9.57	-.96	9.67	264.	3.19	4.63	5.62	35.
1014	90	1360	5.0°	.0052	0.0	.795	-36.93	51.67	63.67	35.	-1.46	-3.85	4.12	200.	-2.26	9.73	9.99	-13.
1015	90	1360	5.0°	.0073	1.92	.796	-119.94	-74.96	141.44	238.	-7.02	4.30	8.23	-59.	-10.34	3.28	10.85	-72.
1016	90	1360	5.0°	.0092	3.72	.800	-113.60	-209.73	237.10	207.	14.51	-23.42	27.55	148.	37.07	-31.28	48.50	130.
1020	90	1360	5.0°	.0065	0.0	.792	-86.11	16.71	87.72	-79.	-7.85	-18.65	20.23	202.	-13.44	14.73	20.07	-43.
1021	90	1360	5.0°	.0084	1.88	.795	-191.84	-47.05	197.57	256.	-21.84	-24.61	32.93	222.	-15.59	18.63	24.55	-41.
1022	90	1360	5.0°	.0124	4.04	.793	-171.47	-105.91	228.4	131.	-3.36	-49.02	49.17	184.	-5.67	-31.65	32.19	190.
1027	90	1360	5.0°	.0044	0.0	.791	10.46	-39.34	40.71	165.	13.93	-17.47	22.34	141.	-5.98	-2.12	6.35	251.
1028	90	1360	5.0°	.0067	1.96	.796	-5.26	-202.00	207.1	181.	-45.57	5.83	45.95	-82.	-9.55	7.09	11.89	-53.
1029	90	1360	5.0°	.0083	3.99	.794	127.97	142.70	195.43	41.	52.38	-110.47	122.26	154.	-70.02	25.54	74.53	-70.
1030	91	950	5.0°	[illegible]	0.0	1.336	115.66	-100.67	153.32	226.	19.24	-37.20	41.88	152.	-13.44	30.01	32.88	-24.
1032	91	950	5.0°	[illegible]	2.01	1.410	-153.52	14.84	154.24	-84.	-31.59	-26.61	41.30	230.	13.70	19.10	23.51	36.
1033	91	950	5.0°	.0144	0.0	1.416	[illegible]	41.81	43.45	-16.	28.68	3.31	28.87	83.	-3.18	-9.24	9.81	199.
1034	91	953	5.0°	.0173	1.02	1.407	[illegible]	-6.58	122.79	267.	-20.65	-27.99	34.78	216.	8.22	15.98	17.97	27.
1035	91	950	5.0°	.0195	2.04	1.419	-122.92	-89.37	151.97	234.	.56	-41.29	41.23	179.	-7.37	21.41	23.02	-19.
1041	91	950	5.0°	.0193	0.0	1.366	4.70	108.70	108.30	3.5	-.73	35.34	35.35	-1.	19.17	2.98	19.40	81.
1042	91	950	5.0°	.0212	1.00	1.367	30.11	12.46	32.44	60.	7.41	-39.74	40.42	169.	-24.26	-3.25	24.47	262.
1043	91	950	5.0°	.0221	1.97	1.381	35.97	131.38	136.22	15.	-7.38	1.71	7.58	-77.	12.55	-1.92	12.70	99.
1044	91	950	5.0°	.0234	2.98	[illegible]	-152.24	30.25	155.22	-79.	-24.20	-33.76	42.73	218.	20.06	14.43	24.71	54.
1045	92	850	5.0°	.0130	0.0	1.578	100.49	27.98	104.31	74.	16.74	-9.58	19.29	120.	-14.65	-17.62	21.69	216.
1046	92	850	5.0°	.0141	1.01	1.568	-141.93	105.29	176.72	-53.	13.06	-23.14	26.57	150.	-13.23	23.36	26.85	-29.
1047	92	850	5.0°	.0210	1.96	1.564	-162.76	-105.15	193.77	237.	5.51	-30.69	31.18	170.	-11.19	15.99	22.91	209.
1048	92	850	5.0°	.0214	0.0	1.579	-169.35	-55.97	178.36	251.	-19.91	-19.84	26.11	225.	13.20	24.24	27.60	28.
1049	92	850	5.0°	.0238	1.04	1.568	-162.38	-83.31	182.50	241.	-19.08	-22.70	29.65	220.	11.72	28.86	31.02	21.
1053	92	850	5.0°	.0260	2.01	1.567	7.55	63.65	64.09	7.	-25.12	4.21	25.47	-81.	9.71	6.26	11.55	57.
1055	92	850	5.0°	.0264		1.549	[illegible]	54.38	69.29	-38.	35.36	-25.85	43.80	126.	-9.66	-17.36	19.50	207.
1056	92	850	5.0°	.0294	1.02	1.597	-45.07	-91.02	101.57	206.	-9.97	-20.46	22.76	206.	3.19	31.11	31.27	6.
1057	92	850	5.0°	.0301	1.92	1.600	-97.57	73.54	122.18	-53.	-22.13	-6.08	22.95	254.	14.58	6.85	16.11	65.
1372	116	950	0.0°	.0052	0.0	1.412	-16.01	-31.84	35.64	206.	-20.93	-16.09	26.39	232.	-3.97	25.86	26.16	-9.
1373	116	950	0.0°	.0016	0.0	1.414	-36.29	-73.96	82.38	206.	21.38	-30.37	37.14	145.	-27.51	2.63	27.64	-85.
1374	116	950	0.0°	.0104	0.0	1.398	-30.96	-24.24	39.32	232.	20.18	-11.32	23.14	119.	-3.05	-7.39	7.98	202.
1376	116	950	0.0°	.0152	0.0	1.408	-66.60	19.94	88.86	-77.	-56.50	-49.93	75.40	228.	-46.13	75.46	88.44	-31.
1377	116	950	7.5°	.0193	0.0	1.404	-77.30	-25.05	81.76	252.	6.02	-49.31	49.68	173.	-6.11	28.36	28.31	-12.
1378	116	950	7.5°	.0202	0.0	1.399	-21.33	3.90	21.68	-79.	-21.59	-46.51	51.28	205.	4.64	26.82	27.22	10.
1379	116	950	7.5°	.0227	0.0	1.366	-28.06	-82.58	87.22	199.	34.60	-37.11	47.20	133.	-19.66	-46.63	50.61	233.
1381	116	950	7.5°	.0249	0.0	1.366	-58.58	-65.67	88.00	221.	10.51	-28.95	30.80	160.	-18.48	4.51	19.02	-76.
1398	116	725	0.0°	.0063	0.0	1.954	3.51	-29.39	29.59	173.	3.10	-17.38	17.65	169.	-22.61	13.56	26.36	-59.
1399	116	725	0.0°	.0200	0.0	1.943	-33.04	-136.34	140.28	193.	35.73	16.86	39.51	65.	1.90	-27.36	22.44	185.
1400	116	725	0.0°	.0371	0.0	1.944	71.36	-65.35	96.76	132.	33.06	128.9	133.07	14.	-7.73	-25.48	26.64	137.
1401	118	725	0.0°	.0378	0.0	1.946	-167.82	-233.83	279.75	217.	68.74	20.92	71.85	73.	-36.78	13.42	38.82	-71.
1405	118	725	2.5°	.0255	0.0	1.930	118.80	-194.09	277.56	140.	87.77	-2.38	87.80	92.	-31.52	-42.48	52.89	216.
[illegible]	121	700	5.0°	.0403	0.0	2.012	-33.57	25.03	41.67	-53.	-21.10	12.22	24.45	-60.	6.34	11.65	13.48	28.
1565	121	700	5.0°	.0441	0.98	2.002	-10.65	-37.05	38.61	196.	14.76	-47.64	45.06	161.	-24.64	-6.84	25.57	254.
1584	121	700	5.0°	.0603	1.93	2.005	36.79	28.71	46.66	52.	45.74	-7.61	49.16	99.	-11.28	-33.15	35.02	199.
1594	121	700	5.0°	.0525	0.0	2.002	-1.29	-70.52	70.52	101.	5.93	-18.00	18.95	162.	-28.52	20.16	33.30	-70.
1595	121	700	5.0°	.0544	0.95	1.994	-43.98	-36.31	57.03	230.	-14.13	-34.02	36.84	202.	-27.42	17.69	32.63	-57.
1596	121	700	5.0°	.0627	1.93	2.013	49.29	9.05	50.11	80.	43.37	-17.56	52.40	169.	-21.11	-22.45	34.43	229.
1627	123	1140	7.5°	[illegible]	0.0	1.192	-48.20	-36.40	60.40	233.	-6.81	-34.98	35.89	191.	-7.69	-16.47	19.18	[illegible]
1628	123	1140	7.5°	[illegible]	1.96	[illegible]	[illegible]	-.77	23.41	92.	-7.03	16.63	17.91	-21.	-3.81	10.79	11.62	-19.
1629	123	[illegible]	7.5°	[illegible]	[illegible]	[illegible]	[illegible]	164.15	[illegible]	-27.	-134.11	-16.97	[illegible]	263.	[illegible]	-33.02	31.76	177.
1632	123	1140	7.5°	[illegible]	[illegible]	1.190	-26.12	74.76	79.41	-20.	-21.59	-42.02	[illegible]	151.	-13.66	-41.06	46.13	297.
1633	123	[illegible]	7.5°	[illegible]	2.05	1.165	92.76	-120.79	[illegible]	142.	-38.91	-5.08	38.24	262.	-7.99	-27.99	28.06	156.

TABLE C-1 NASA AMES FIXED SYSTEM 4/REV HUB LOADS DATA - THRUST, ROLLING MOMENT, PITCHING MOMENT

CORR	RUN	RPM	α_s	C_T	θ_{2p}	μ	FX4C	FX4S	FX4	φFX4	FY4C	FY4S	FY4	φFY4	Q4C	Q4S	Q4	φQ4
1003	88	1670	5.0°	.0048	0.0	.296	-31.82	-2.27	31.90	266.	-19.07	-21.01	28.37	222.	-.982	.624	1.16	-57.
1005	88	1670	5.0°	.0085	0.0	.295	-13.65	39.00	41.32	-19.	-21.08	28.47	35.42	-36.	-.584	3.12	3.17	-11.
1006	88	1670	5.0°	.0110	0.0	.295	-33.53	26.25	42.58	-52.	-39.93	62.77	74.39	-33.	-.853	-.709	1.21	230.
1007	88	1670	5.0°	.0130	0.0	.298	-70.02	-36.50	78.96	243.	-36.98	-14.68	39.79	248.	-2.28	-3.60	4.26	217.
1009	89	1630	5.0°	.0052	0.0	.497	-87.90	14.10	89.02	-81.	-41.85	-57.86	71.41	216.	-.68	-2.45	2.54	195.
1010	89	1630	5.0°	.0057	0.0	.498	-133.65	-59.94	146.48	246.	-17.74	-48.81	51.93	199.	2.12	.31	2.14	87.
1011	89	1630	5.0°	.0065	0.0	.498	14.97	7.80	16.88	62.	-4.58	54.34	54.53	-5.	2.28	.25	2.29	83.
1014	90	1360	5.0°	.0052	0.0	.795	-5.72	33.71	34.19	-10.	8.33	25.08	26.43	18.	-.65	-.65	.92	225.
1015	90	1360	5.0°	.0073	1.92	.796	-98.35	-32.18	163.48	252.	48.30	-52.59	71.40	137.	-4.89	-4.95	6.90	223.
1016	90	1360	5.0°	.0092	3.72	.800	-30.54	-151.05	154.11	191.	262.32	50.76	267.19	79.	.78	-3.34	3.41	167.
1020	90	1360	5.0°	.0065	0.0	.792	-16.50	42.53	45.62	-21.	24.07	5.24	24.63	78.	2.86	.62	2.93	72.
1021	90	1360	5.0°	.0084	1.88	.795	71.62	7.21	71.98	84.	60.12	111.81	126.95	28.	-5.84	-3.89	7.02	206.
1022	90	1360	5.0°	.0104	4.04	.793	-88.86	53.48	103.71	-60.	106.78	29.13	110.70	74.	-4.49	-2.30	5.04	242.
1027	90	1360	5.0°	.0044	0.0	.791	-5.78	1.30	5.92	-77.	-41.65	43.46	60.19	-44.	1.37	.42	1.43	73.
1028	90	1360	5.0°	.0067	1.98	.794	-11.31	-77.78	79.60	188.	-59.98	-14.49	64.71	256.	-.06	-4.91	4.91	181.
1029	90	1360	5.0°	.0083	3.99	.794	-34.75	86.44	93.16	-22.	67.28	21.04	70.49	73.	1.19	3.11	3.33	21.
1030	91	950	5.0°	.0114	0.0	1.396	4.60	137.36	137.43	2.	59.71	-22.50	63.80	110.	-12.35	-7.68	14.54	238.
1031	91	950	5.0°	.0179	2.01	1.410	70.77	127.85	146.13	29.	50.10	-15.24	57.37	107.	-12.31	7.36	14.34	-59.
1033	91	950	5.0°	.0154	0.0	1.416	-5.71	-92.06	92.24	184.	5.74	45.22	45.58	7.	.40	.14	.425	71.
1034	91	950	5.0°	.0173	1.02	1.407	66.64	96.72	117.46	35.	29.17	-25.99	39.06	132.	-11.38	3.67	11.96	-72.
1035	91	950	5.0°	.0195	2.04	1.419	10.17	164.38	165.20	4.	49.77	23.01	54.83	65.	-15.99	-3.85	16.45	256.
1041	91	950	5.0°	.0193	0.0	1.386	-80.28	-77.70	116.11	228.	-55.31	89.16	104.09	-32.	.44	2.16	2.20	11.
1042	91	950	5.0°	.0212	1.00	1.387	-141.03	96.58	173.42	-56.	5.71	59.42	59.69	5.	-2.67	-1.30	2.97	244.
1043	91	950	5.0°	.0221	1.97	1.381	96.81	-8.64	97.19	95.	-67.41	18.88	70.00	-74.	2.46	1.63	2.95	56.
1044	91	950	5.0°	.0244	2.9[illegible]	1.389	94.88	113.64	148.04	40.	54.66	-27.07	60.39	116.	-5.84	15.42	16.49	-21.
1045	92	850	5.0°	.0140	0.0	1.578	-99.89	-27.53	103.61	254.	-43.19	48.59	65.01	-42.	5.29	-2.39	5.80	114.
1046	92	850	5.0°	.0181	1.01	1.583	-63.39	131.81	146.26	-26.	60.99	1.15	61.00	89.	-4.64	-2.24	5.15	244.
1047	92	850	5.0°	.0210	1.96	1.584	-77.05	159.21	176.87	-26.	17.49	-6.09	18.52	109.	-9.45	-2.53	9.78	255.
1048	92	850	5.0°	.0214	0.0	1.579	7.56	122.62	122.85	4.	51.19	26.23	57.52	63.	-4.88	3.54	6.03	-54.
1049	92	850	5.0°	.0238	1.04	1.559	-21.26	139.10	141.03	-9.	-2.01	16.03	16.15	-7.	-11.28	1.88	11.44	270.
1050	92	850	5.0°	.0260	2.01	1.587	54.73	28.21	61.57	63.	-9.26	-52.97	53.77	189.	-1.29	3.89	4.09	-18.
1055	92	850	5.0°	.0254		1.589	-70.54	-58.31	91.52	230.	26.96	7.38	27.95	75.	-.78	.35	.85	-66.
1056	92	850	5.0°	.0294	1.02	1.597	-61.49	123.24	137.73	-27.	-10.95	27.29	29.40	-22.	-11.47	.07	11.47	-90.
1057	92	850	5.0°	.0301	1.92	1.600	58.55	17.15	61.01	74.	-18.56	-26.94	37.71	214.	-3.05	3.24	4.98	-33.
1372	116	950	0.0°	.0052	0.0	1.412	-18.47	45.91	49.49	-22.	24.30	-7.99	24.49	97.	-.75	-.24	.78	252.
1373	116	950	0.0°	.0016	0.0	1.414	-36.92	5.12	37.27	-82.	1.95	26.52	26.59	4.	-1.43	-4.71	4.52	195.
1374	116	950	0.0°	.0104	0.0	1.398	-21.27	35.14	41.07	-31.	-21.67	2.44	21.81	-84.	-.57	1.38	1.49	-22.
1376	116	950	0.0°	.0152	0.0	1.408	-7.64	8.22	11.22	-43.	31.72	47.69	44.68	45.	-1.53	4.12	4.39	-23.
1377	116	950	7.5°	.0133	0.0	1.404	31.10	7.48	32.27	76.	-27.15	-11.59	29.52	247.	-11.16	-1.67	11.29	261.
1378	116	950	7.5°	.0232	0.0	1.398	-11.12	81.02	87.78	-3.	16.64	5.43	17.50	72.	-7.33	.52	7.34	-66.
1379	116	950	7.5°	.0227	0.0	1.386	-103.26	38.68	110.27	-69.	-32.17	-1.32	32.19	267.	-2.35	-.32	2.37	262.
1381	116	950	7.5°	.0269	0.0	1.386	-2.60	44.87	44.95	-3.	-20.54	63.15	66.44	-19.	-4.18	-2.83	5.05	235.
1398	118	725	0.0°	.0083	0.0	1.954	-.45	-9.18	9.19	182.	-14.68	12.41	19.22	-50.	-2.33	-3.04	3.83	218.
1399	118	725	0.0°	.0260	0.0	1.943	-.84	-2.53	2.66	198.	-10.71	-18.65	21.51	209.	-2.56	-3.79	4.57	214.
1400	118	725	0.0°	.0371	0.0	1.944	-34.17	13.48	36.73	-68.	2.33	-70.77	70.80	178.	.18	-.33	.375	151.
1401	118	725	0.0°	.0378	0.0	1.846	.92	17.76	17.78	3.	-16.16	-1.94	16.28	263.	-5.99	-7.03	9.23	220.
1405	118	725	2.5°	.0255	0.0	1.930	-24.75	-29.99	38.89	213.	-13.84	-27.21	30.53	207.	2.71	-6.25	6.81	156.
1584	121	700	5.0°	.0403	0.0	2.012	-14.98	4.27	15.54	-74.	.65	-15.50	15.51	177.	-1.45	2.26	2.68	-33.
1585	121	700	5.0°	.0461	0.98	2.002	-35.31	-13.67	37.86	243.	-14.68	14.49	20.63	-45.	-.29	-1.61	1.64	190.
1586	121	700	5.0°	.0603	1.93	2.005	-13.73	-37.35	39.73	203.	-15.94	13.5	20.94	-49.	3.14	3.43	4.65	42.
1594	121	700	5.0°	.0525	0.0	2.002	-17.33	31.92	34.22	[illegible]	9.72	2.73	9.97	77.	1.02	-4.16	4.28	194.
1595	121	700	5.0°	.0594	0.95	1.998	-1.29	7.86	7.99	[illegible]	8.49	30.33	31.50	16.	-3.89	-3.13	4.99	271.
1596	121	700	5.0°	.0627	1.93	2.003	-27.67	-17.19	32.63	237.	-27.70	-1.63	27.75	266.	2.73	2.78	3.89	44.
1627	123	1140	7.5°	.0145	0.0	1.192	-3.37	-1.33	3.62	248.	-1.48	-28.79	28.53	163.	5.49	6.22	8.29	41.
1628	123	1140	7.5°	.0113	1.96	1.193	21.23	-13.86	27.05	120.	-50.20	53.98	73.72	-41.	.85	-1.32	1.57	147.
1629	123	1140	7.5°	.0090	1.86	1.190	-14.54	-4.37	15.18	107.	.41	-55.45	55.45	179.	-6.25	4.39	7.63	-55.
1632	123	1140	7.5°	[illegible]	0.0	1.190	41.64	-10.69	42.99	105.	-33.29	50.87	60.79	-33.	2.35	4.04	4.67	30.
1633	123	1140	7.5°	[illegible]	2.05	1.188	61.26	-82.56	97.16	148.	-7.82	.49	7.84	-86.	8.37	-.04	8.37	90.

TABLE C-2 NASA AMES FIXED SYSTEM 4/REV HUB LOADS DATA - LONGITUDINAL FORCE, LATERAL, FORCE, TORQUE

APPENDIX D DERIVATION OF GENERALIZED COORDINATE METHOD FOR OBTAINING HUB LOADS

The development of helicopter vibratory hub loads from blade bending moments is based upon

a) generalized coordinate theory

b) trignometric transformation of rotating blade shears and moments to the fixed system

Generalized coordinate theory assumes that the forced response of a vibrating system (a particular degree of freedom) is the summed response of all the natural modes of vibration. For the blade vertical degree of freedom, the natural modes involved are the blade flapping modes and the summed response of interest are the root vertical shears and moments. These blade root shears and moments are the sources of hub vibration (F_z, M_x, M_y) which are then transmitted to the airframe below. For the inplace degree of freedom the natural modes involved are the blade chordwise modes. The root shears and moments from these modes produce 3 additional hub vibration components (Q, F_x, F_y). Blade radial forces also contribute to F_x and F_y.

The pricipal equation for application of generalized coordinates is as follows:

$$(1) \quad \text{Bending Moment}_{\substack{\text{HAR A} \\ \text{Sta } i}} = \sum_{j=i}^{NM} \text{Modal moment}_{\substack{\text{Sta } i \\ \text{Mode } j}} \times q_{\substack{\text{Mode } j \\ \text{HAR A}}}$$

The equation states that the measured blade bending moment amplitude at station (i) on the blade for a certain harmonic (A) is the summed contribution of modal moments at station (i) for mode (j) times generalized coordinates for mode (j) for all modes considered (NM). Note that for each blade station there is a modal moment value for each mode whereas there is only 1 generalized coordinate for each mode for harmonic (A). When a number of blade stations are considered (NS), the left hand side of equation becomes a column matrix (order NS), the modal moments become a rectangular matrix (order NS x NM) and the generalized coordinate becomes a column matrix (order NM) for each harmonic considered.

(2) $(BM_{NS}) = (MM_{NS,NM}) \cdot (q_{NM})$

This equation is a set of (NS) simultaneous linear equations in (NM) unknowns with the generalized coordinates being the unknown variables. The bending moments are measured blade data, and the modal moments are known from a free vibration analysis of the blade. The number of stations where blade bending moments are measured must be at least equal to the number of modes under consideration so that the number of equations is at least equal to the number of unknowns.

The generalized coordinates are found by inverting the modal moment matrix and multiplying it by the measured bending moment matrix.

$$(q_{NM}) = (BM_{NS}) \cdot (MM_{NS,NM})^{-1}$$

For the case where the number of stations are greater than the number of modes (NS > NM) so that number of equations are greater than number of unknowns, a linear least square fit is performed to compute the generalized coordinates and an error analysis of the result is included.

The blade root shears and moment of harmonic (A) are then simply computed as follows:

$$(3) \quad \underset{\text{Harmonic A}}{\text{Root Shear}} = \sum_{j=1}^{NM} \underset{\text{Mode j}}{\text{Modal Root Shear}} \times q_{\substack{\text{Mode j} \\ \text{HAR A}}}$$

$$(4) \quad \underset{\text{Harmonic A}}{\text{Root Moment}} \quad \sum_{j=1}^{NM} \underset{\text{Mode j}}{\text{Modal Root Moment}} \times q_{\substack{\text{Mode j} \\ \text{HAR A}}}$$

The computation procedure (equation 1 thru 4) is repeated for each harmonic (cosine and sine) thru 5 per rev so that the root shears and moments applicable to 3 and 4 bladed rotors are included.

The fixed system hub loads are computed from the root shears and moments by trignometrically adding the appropriate contributions based on the numberof blades per rotor(N) and also by the root end geometry (Flap hinge E_β, lag hinge E_ζ and pitch axis offset E_o).

The flapping degree of freedom is the source of 3 hub loads components: F_z, M_x, M_y. The hub loads equations for these components are shown below for 4 bladed rotors.

4 Blades

5a $F_{zo} = 4\ f_{zo}$

b $F_{z4c} = 4f_{z4c}$

c $F_{z4s} = 4f_{z4s}$

6a $M_{xo} = 2[f_{z1c}\ E_o + f_{z1s}\ E_\beta + M_{\beta 1s}]$

b $M_{x4c} = 2[E_o\ (f_{z3c} + f_{z5c}) - E_\beta\ (f_{z3s} - f_{z5s}) - M_{\beta 3s} + M_{\beta 5s}]$

c $M_{x4s} = 2[E_o(f_{z3s} + f_{z5s}) - E_\beta(-f_{z3c} + f_{z5c}) + M_{\beta 3c} - M_{\beta 5c}]$

7a $M_{yo} = 2[f_{z1s}\ E_o - f_{z1c}\ E_\beta - M_{\beta 1c}]$

b $M_{y4c} = 2[E_o(-f_{z3s} + f_{z5s}) - E_\beta\ (f_{z3c} + f_{z5c}) - M_{\beta 3c} - M_{\beta 5c}]$

c $M_{y4s} = 2[E_o(f_{z3c} - f_{z5c}) - E_\beta\ (f_{z3s} + f_{z5s}) - M_{\beta 3s} - M_{\beta 5s}]$

8 per rev hub loads can be calculated with the above equations by replacing the 3, 4 and 5 harmonic subscripts with 7, 8 and 9 harmonic subscripts, respectively.

APPENDIX E - TABULATION OF GENERALIZED COORDINATE HUB LOADS DATA

The generalized coordinate method discussed in Appendix D was used to compute the vibratory hub loads from the reverse velocity rotor wind tunnel test - Phase IIB. Table E-1 presents a summary of the generalized coordinate 4/rev fixed system hub loads.

TABLE E-1 GENERALIZED COORDINATE 4/REV HUB LOAD DATA

(PROGRAM C-63)

RUN NO.	CORR NO.	ADVANCE RATIO μ	RPM	SHAFT ANGLE α_s DEG	2P COSINE CYCLIC θ_{2c} DEG	HUB VIBRATORY VERTICAL FORCE F_{z4} LB	HUB VIBRATORY MOMENT M_{xy4} IN LB
84	913 915 917	0.7	1440	5	0 2 4	82 10 100	220 450 510
85	928 930	0.9	1300	5	0 2	40 30	300 456
86	943 945 947	1.2	1120	5	0 2 4	100 40 110	1400 1230 1430
87	954	1.4	960	5	0 2 4	60 60 200	1300 1700 1860
88	1005	0.3	1670	5	0	7	63
89	1011	0.5	1630	5	0	32	250
90	1020 1021 1022	0.79	1360	5	0 2 4	40 70 70	245 245 385
91	1041 1042	1.4	950	5	0 .1	75 20	1709 1815
92	1043 1044	1.6	880	5	0 2	25 65	840 1040
116	1381	1.4	950	7.5	0	55	1300
118	1400	1.95	725	0	0	70	130
121	1584 1586	2.0	700	5	0 1	100 100	337 354
123	1627 1628 1629	1.2	1140	7.5	0 2 4	40 40 30	1150 1100 930

APPENDIX F - MODEL BLADE AND MODEL/TEST STAND DYNAMIC CHARACTERISTICS

A summary of the dynamic characteristics of the blade and model/test stand dynamic characteristics are presented herein. This information is presented in Reference 1 and is repeated here with only a brief description of the data. Figure F-1 presents the predicted flapwise frequency spectrum for the RVR model blade. Figure F-2 shows the predicted modal characteristics for the first flapwise mode using a free vibration analysis for both 1/2 and 1 atmosphere. The upper part of the figure shows the percent critical damping for the first flexible mode as a function of rotor speed. Note that a 50 percent reduction in air density results in a 50 percent reduction in critical damping. The predicted impact of the reduction of damping on flap bending moments is shown in the lower half of Figure F-2. A coefficient, that is a modified generalized coordinate for the first mode 3/rev response, is shown for both 1/2 and 1 atmospheres as a function of rotor speed. For rotor speeds near the 3/rev frequency crossing, the reduction in damping stated above has increased the modal amplification so that the benefits obtained from a 50 percent decrease in airloadings are negated.

Figure F-3 shows the measured model rotor head longitudinal acceleration which was recorded during the model checkout. There is a 2/rev amplification near 1350 RPM (182×10^4 on the RPM^2 scale) and 3/rev and 4/rev amplifications at lower rotor speeds. These amplification points verify the presence of a longitudinal model/test stand mode and are compared with pretest predictions in Figure F-4.

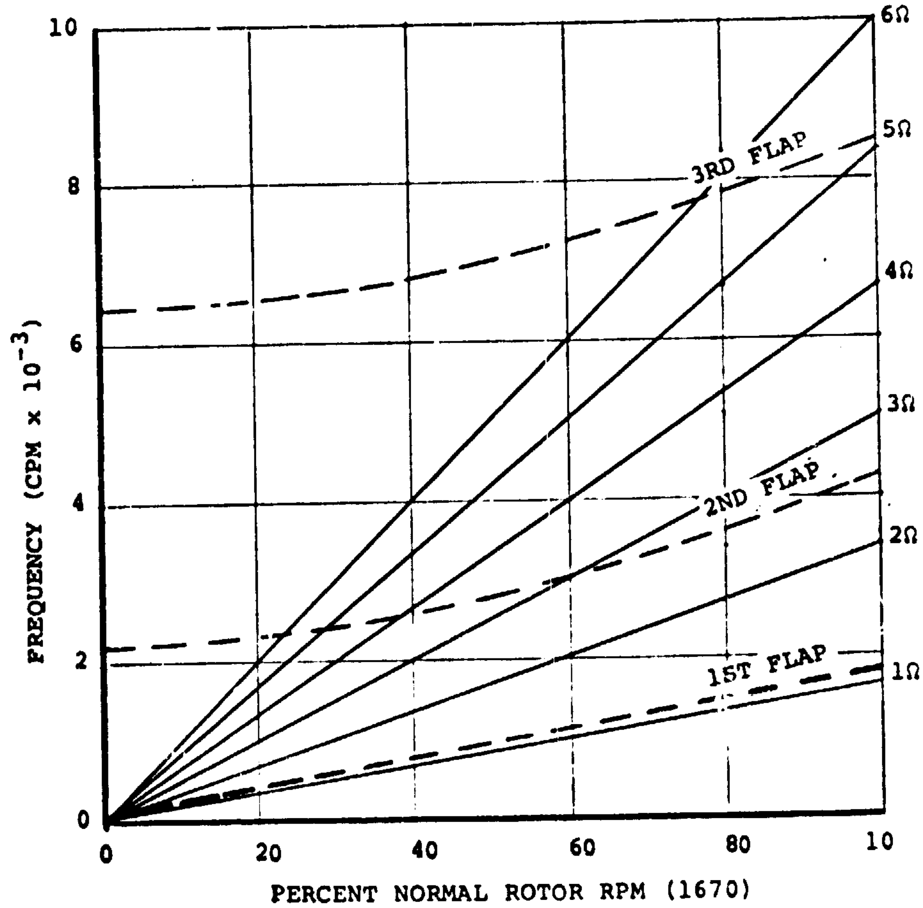


FIGURE F-1   RVR WIND TUNNEL MODEL BLADE PREDICTED FLAPWISE FREQUENCY SPECTRUM

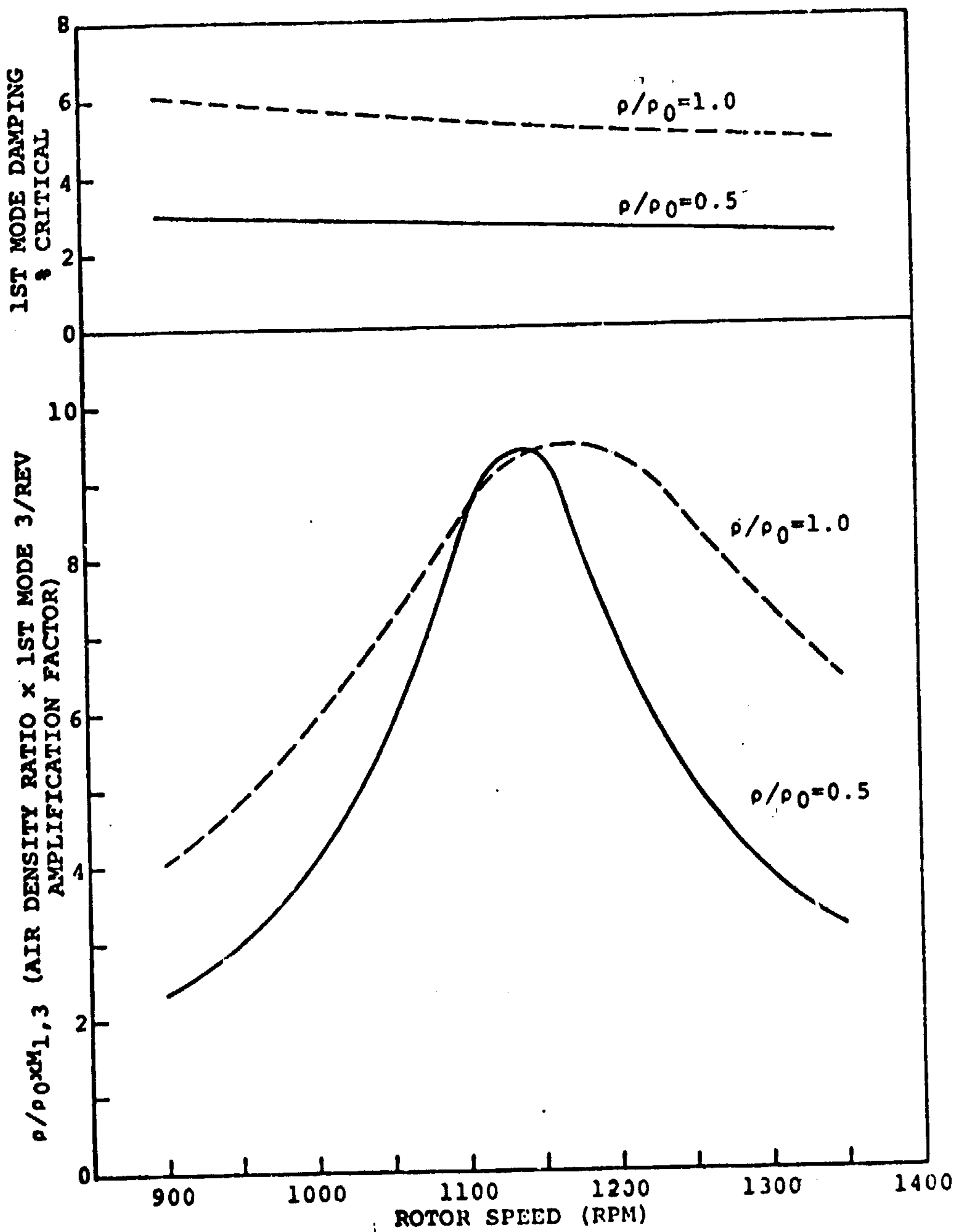


FIGURE F-2 RVR PHASE IIB W/T MODEL PREDICTED MODAL CHARACTERISTICS FOR 1ST FLEXIBLE FLAP MODE AS AFFECTED BY AIR DENSITY

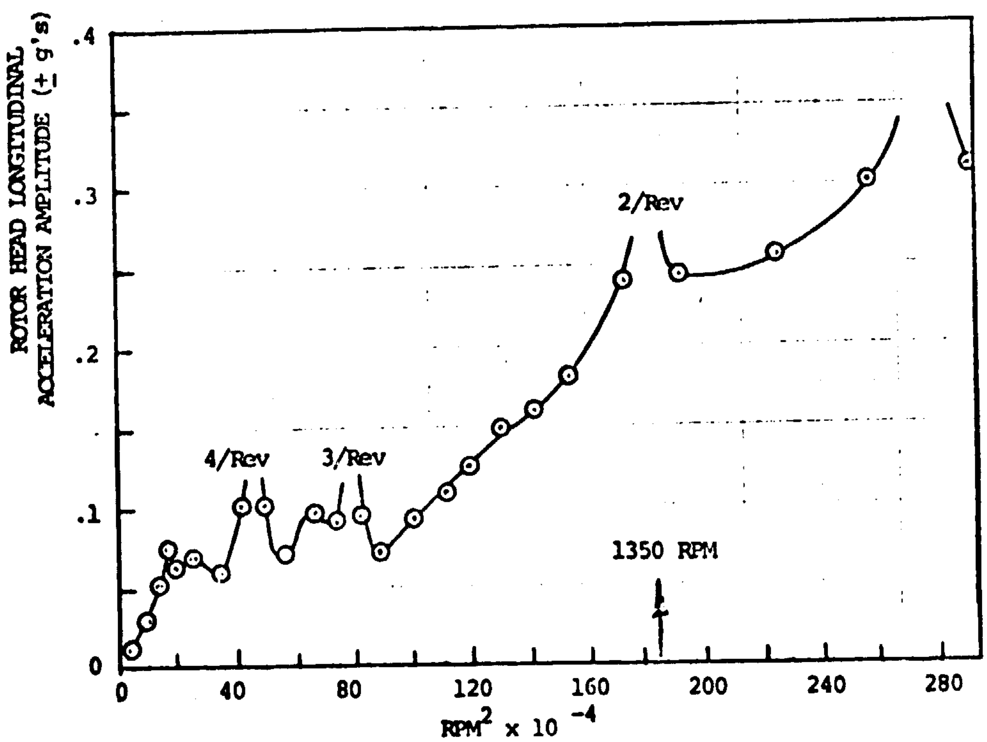


FIGURE F-3 RVR PHASE II B W/T MODEL EFFECT OF ROTOR SPEED ON LONGITUDINAL MODEL/ TEST STAND SHAKING

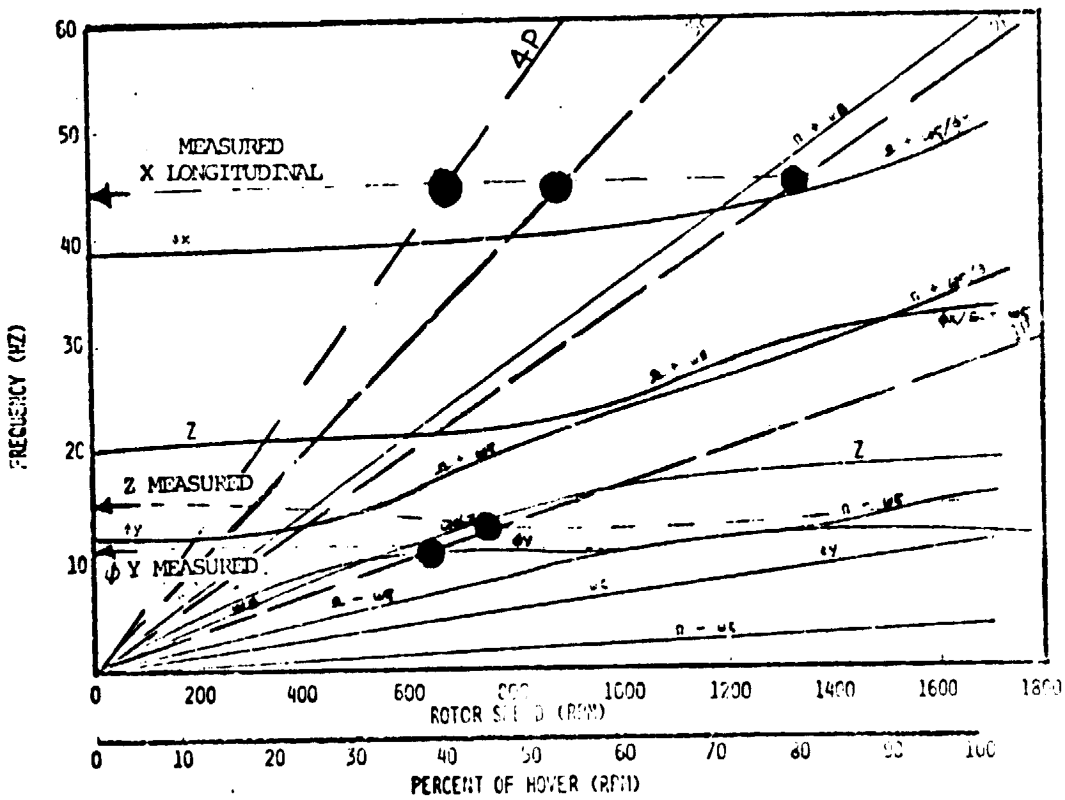


FIGURE F-4 RVR PHASE II B W/T TEST COMPARISON OF PREDICTED AND MEASURED MODEL/TEST STAND NATURAL FREQUENCY SPECTRUM